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Approach

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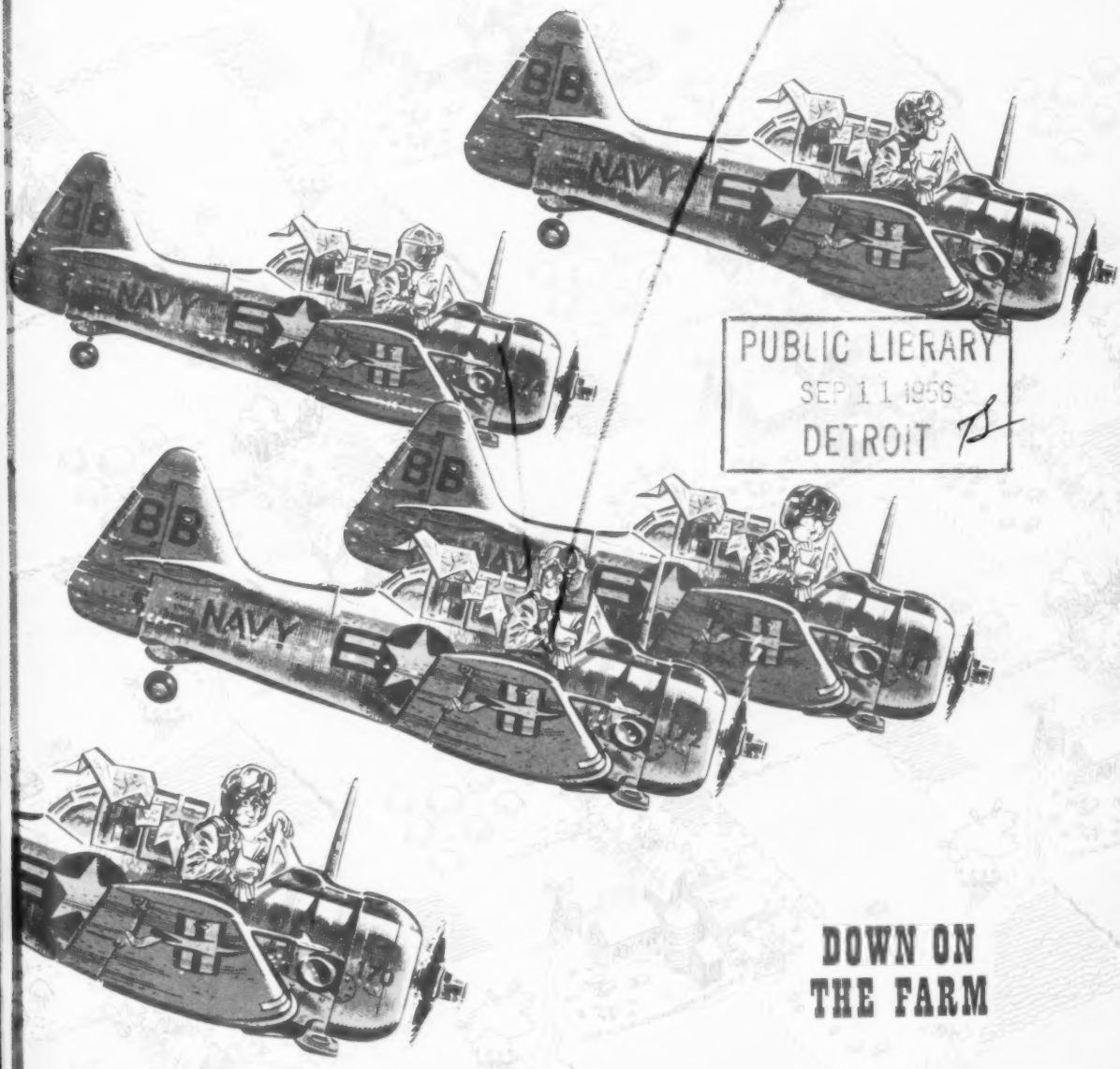

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DOWN ON THE FARM

Approach

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No. 2

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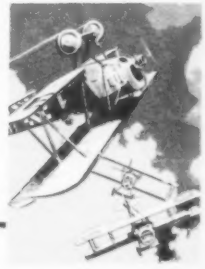
DOWN ON THE FARM ..... page 4

Another glance at this month's cover should reveal artist Ted Wilbur's wallpaper repetition of terrain features which sometimes makes navigation checkpoints difficult to identify. Then turn to page 4 and climb into an SNJ cockpit for an interesting cross-country flight that ended up "Down on the Farm."

ASSUME THE ANGLE ..... page 10

With "Assume the Angle" on page 10, CDR A. H. Reid concludes his "Primer for Pilots" series of pilot-engineer discussions of significant flight problems. For the many "regular" *Approach* readers who expressed approval of this type of presentation, we think you'll agree this is one of his best.



MENTAL STRESS ..... page 34

In spite of legends, pilots are still people. The flight surgeon reports that pilots sometimes need to know when not to fly, as well as how to fly. But said decisions don't come easy—and they might provide a basis for "Mental Stress," page 34. Equal billing is given "Suspicion," page 36, which reviews problems of vertebra injuries, and which in turn relates directly to "Flare Not" in the Flight Operations Section.

This periodical contains the most accurate information currently available on the subject of aviation accident prevention. Contents should not be construed as regulations, orders or directives unless so stated. Material extracted from Aircraft Accident Reports, OpNav Form 3750-1 and Anymouse (anonymous) Reports may not be construed as incriminating under Art. 31, UCMJ. Names used in accident stories are fictitious unless stated otherwise. Photo Credit: Official Navy or as credited. Original articles may be reprinted with permission. Contributions are welcome as are comments and criticisms. Address correspondence to Director, U. S. Naval Aviation Safety Center, NAS Norfolk 11, Va.

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Letters to the Editor

Sir:

. . . "Time Zero," May *Approach* . . . I don't believe you went far enough back into the past in your chronological report on the ticking of the time bomb.

I believe that the bomb started ticking at the moment that this installation, with oxygen system, throttle linkage, and elevator control cables in such a juxtaposition, was laid out on the drawing board. As we follow the ticking toward the present . . . we will find another set of major culprits . . . or haven't they heard of Murphy's Law?

C. G. LIVINGSTON
Test Pilot and Flight Safety
Consulting Engineer
Redondo Beach, California

P.S. . . . BuNo 123456 belongs to a straight-wing F9F. Coincidence?

Them's kind words, pardner, in support of the cause. . . . BuNo 123456 was coincidental. —Ed.

Sir:

The Armed Forces Foreign Car Club . . . viewed with great interest your "Snooze in the Night," May *Approach*. We were particularly interested in your comparison between an alert sports car driver and an alert pilot *vs* those who drive "too-easy-drive vehicles and aircraft." It is a point our organization . . . has been trying to bring to light for many months. . . .

JERRY BERNIER
Corresponding Secretary
and Publicity Chairman
Armed Forces Foreign
Car Club, P. O. Box 2358
Honolulu, T. H.

Sir:

In your article "Here We Go Again," May issue of *Approach*, you have the Aircontrolman listed as operating VHF/DF gear. Check that please if you will sir. He appears to be operating URD4, UHF/DF gear.

JAMES R. COCHRAN AC1
Operations (Flight)
NAS Jax

You are correct—a typographical error made it VHF.—Ed.

Sir:

. . . "How to See at Night." The author was a flight surgeon, as I recall, who said some nasty things about pilots who don't do the proper things to preserve their night vision.

The Naval Aviation Safety Center has placed a great deal of emphasis on improving and preserving night vision, and I find no fault with that attitude. I do feel, however, that BuAer's apparent policy of not installing taxi lights on combat aircraft is the basic cause of most night taxi accidents to that type.

It seems ridiculous to blame pilots for not seeing like cats when the obvious answer is to put some light on the subject. Of course some operational conditions prevent the use of taxi lights, but why must we grope around for the remaining 99 percent of the time?

In the same vein, . . . [some] naval air stations, expect the unwary pilot to thread his way at night through a maze of parked aircraft and ditches when he has no lights, with no instructions from the tower . . . [some] stations don't own a "follow me" vehicle.

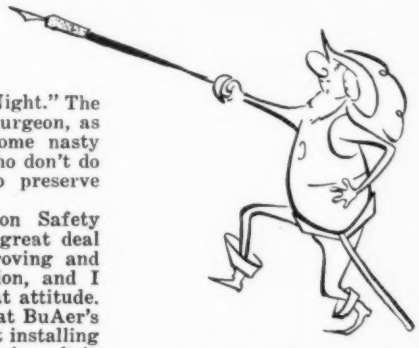
"Pilot Error" is a convenient way to place the blame for accidents, but I believe that some pilot errors are built into the airplane or are caused by conditions beyond the pilot's control. I suggest that *Approach* publish an article on this subject.

R. E. FIGLEY, COL, USMC
Industrial College
of the Armed Forces
Washington, D. C.

We go along with you. Facilities and design for night taxiing are at fault in many such cases—and the pilot ends up being the convenient goat. Pending results of a facility survey now underway Approach *hopes to review the problems of air station lighting in the near future.*

Sir:

OMNI [June *Approach*] is not really new but many pilots are still unfamiliar with it. I think ARA-25 equipment is in the same category. . . .



I am forwarding [information used] . . . to indoctrinate pilots in the USAF Instrument Pilot Instructors School here at Moody. . . .

In "Who Checks the Checkers?" May *Approach* there is a glaring error in ATC phraseology "cruise and maintain 31,000 feet." There is no such term as "cruise and maintain." You must be doing one or the other, but never both.

. . . "Cruise" signifies that descent may be commenced at pilot's discretion. This means that the pilot has all altitudes between the assigned cruising altitude and the minimum en route altitude and can commence a letdown en route without any further clearance from ATC . . .

Military pilots [seldom] receive cruise clearances due to the nature of their operations. . . . "maintain" means that a pilot must maintain that altitude until he receives further clearance to change altitude.

On page 2, May; LCDR E. L. Hutcheson referred to section 61.273 of the Civil Air Regulations concerning instrument approach minimums. This is incorrect as part 61 of the *C.A.R. is scheduled air carrier rules* and is not applicable to other than airliners.

LT JOHN RALSTON, JR.,
USN, Senior Naval Officer
3550th Combat Crew
Tra Grp (1)
Moody AFB, Ga.

You are so right. The Omni article appeared in Approach, *June 1956. Thanks for the ARA-25 info. If enough* Approach *readers indicate they want it, we'll print it.—Ed.*

More on next page

Sir:

We are regular readers of your good magazine, *Approach*, and have utilized several of its lessons in connection with the design of our latest private venture airplane, the Model 73 *Beechcraft* primary jet trainer. This airplane recently has gone through an evaluation at Patuxent. Some of the features that we have incorporated on the basis of your good publication are outlined in the pamphlet which we are attaching hereto.

In the May 1956 issue of *Approach*, we note the story, "Here We Go Again!" . . . We constantly are trying to indoctrinate civilian pilots with the idea of not killing themselves by trying to fly through thunderstorms with inadequate training. . . . would like to reprint portions of the article . . . particularly, . . . "If you can't go over, or go under or go around—go home!" This is the gist of what we have been telling our readers for the past 15 years. . . .

Sincerely yours,
JOHN P. GATY
Beech Aircraft Corp.
Vice President-General Manager

Thanks. As for "Here We Go Again," reprint any of it you wish.—Ed.

Sir:

In the May 1956 issue of *Approach* one word was deleted from a sentence on page 43, that changed the meaning of the sentence completely. No. 10 and ¼ bolts with cotter pin holes shall *not* be used with elastic stop-nuts is the way the sentence should have read. Burrs in the cotter pin holes or the sharp edges of the threads cut the elastic liner. On larger bolts the holes are beveled, thus eliminating this problem.

MURRY SCHOENBERGER
Associate Structure Engr.
G. L. Martin Co.
Baltimore, Md.

You are correct. This error was also acknowledged in June Approach *"Letters."—Ed.*

Sir:

With the increasing size of most naval air stations the problem of finding a windsock or tetrahedron is becoming more and more difficult, particularly to transient pilots. Many stations are adopting a policy of placing a windsock over the runway duty officer wagon or Wheels sign on all runways. The sock could be made of a high visibility material.

Safety Officer

Good idea. Just another example of one of the many details of this flying business, and a rather basic and fundamental detail that is perhaps neglected in this modern day, with lots of radios, mobile control monitoring . . .—Ed.

Sir:

I have been receiving your magazine *Approach* for 8 or 10 months and consider it an excellent publication in all respects.

I have quite a few years experience in the aircraft maintenance field and your report "Time Zero!" in the May issue hit the most serious maintenance problem squarely on the head. That report is the best written and illustrated item that I have ever read. I feel that it should be required reading for Air Force maintenance and air crew personnel.

Am referring "Time Zero!" to a number of my AF friends. . . .

RICHARD W. ETTER
Colonel, USAF
Armed Forces Staff College
Norfolk, Va.

Sir:

Preoccupied by attempting to tune a malfunctioning ARN-6, Anymouse neglected to come back from his 100% takeoff RPM until the white overtemp light came on at about 32,000 feet. Airspeed was down to about 190. Flight was marked only by controlling TPT fixation thereafter, and postflight inspection showed "no harm."

This sort of thing happens fairly often. It has caused its share of turbines to fail, no doubt, and may be more serious in hotter engines.

How about running a series of electron microscope photographs and sketches which show the change in the crystal structure as metal overtemps?

I am sure a feature on this would clarify the overtemp problem for many pilots and mechs.

Despite the drop-your-funny-books-boys! approach, most *Approach* articles, and semi-technical writeups, like the test pilot notes, really go over big.

Anymouse

Photos coming up! Another article on the subject of overtemps, its causes and control is slated for printing soon. Meanwhile, a review of "TPT Tells The Tale," November Approach *may help.—Ed.*

Sir:

. . . "Murphy's Law" . . . *Approach*, April, points the necessity of reporting errors in technical publications to reduce accidents caused by improper or lack of adequate instructions.

. . . As long as it is necessary to write an official letter to point out the errors . . . our technical publications will continue to carry incorrect information . . .

. . . What is necessary, is a simplified system of reporting errors that maintenance personnel can understand . . . the FUR system has proven itself and it appears that a similar idea can be applied to reporting errors in technical manuals . . .

STEPHEN BATUK, LCDR

The Naval Aviation Safety Center concurs that there is a definite need for a simple form that readily lends itself to reporting errors, in technical manuals. However, it is felt that the forms should be reviewed by qualified officers of the division officer or department head level as appropriate.—Ed.

Letters may be forwarded either via official channels or direct on Anymouse forms. All letters should be signed, names are withheld on request. Address Approach Editor, U. S. Naval Aviation Safety Center, NAS Norfolk 11, Virginia.

Editorial

'IT DIDN'T HAPPEN ON MY WATCH, CHIEF'

A traditional strategem to expedite the movement of administrative hot potatoes and to get the monkey off unwilling backs might be summed up in the familiar protest: "It didn't happen on *my* watch, Chief!"

Where aviation safety is concerned, such a tendency to avoid responsibility becomes rather disturbing when, for example, commands and individuals demonstrate a certain reluctance to participate in crash investigations being conducted by a nearby or related activity.

The fact that a particular airplane involved in a crash may not be "owned" by another command does not prohibit interested observation and voluntary cooperation in the investigation. In fact, the assigned investigative group would undoubtedly be grateful for any assistance, particularly if this was in the form of the loan of a USC Safety School graduate.

Nor is this sort of cooperation the exclusive concern of squadrons—air stations, type commanders and area commanders may also profit to a significant degree from man-hours invested in the investigation of local-occurring crashes.

Consider this for local application: While it is loudly affirmed that aviation safety is *everybody's* business, folks are still warily evasive about volunteering for any activity which might involve extra effort, regardless of the potential benefit.

With so very much to be learned about the complex business of military aviation, it seems completely reasonable to invite cooperation, and to encourage mutual support of the vital effort of aircraft accident investigation. A good investigation, unhampered by the inertia of indifference, will provide the best answer to the all-important question of "Why" an aircraft accident occurred.

End of briefing lecture—*you* now have it.

DOWN ON THE FARM

Few, if any, aviators may honestly claim that they have never been lost sometime in their flying careers.

Individual situations differ only in detail and in the significance of the final outcome. The continuing record of instances of "lost" aircraft is ample evidence of the pilot's constant exposure to this inherent problem of flying. Airplane models may vary; time, distance and speed factors may change, but the basic principles of navigation remain unaltered.

Occasionally, a particularly impressive example of this problem appears to lend emphasis to the unchanging importance of certain fundamentals, such as a ready answer to the question of "Where am I, now?"

The following account of such a situation is offered without editorial comment, and with only the reminder that the professional aviator will substitute his own aircraft model for the venerable SNJ—will project this sort of situation into his own sphere of flight operations and perhaps thereby insure that "It won't happen to me."

The lady of the house on the small southern farm took one look at what was happening in the field adjoining the road, and dashed for the telephone. Only a moment was required to get her doctor husband at his office in the small town nearby.

"You better get right on out here," she yelled excitedly, "there's airplanes landing all over the place!" And she slammed down the receiver and ran back to watch the goings on.

At the other end of the line a puzzled doctor stared a moment at the phone in his hand while an assortment of mental

Continued next page

DOWN ON THE FARM

Continued

pictures crowded before his eyes. Then he reached hurriedly for his hat . . .

It had all begun just like any other "I-2" cross-country training flight, with an instructor, four students, five SNJs and a one-plus-fifty navigation flight to an airport about 190 miles away. Along the Gulf Coast that morning the weather was just about all a young pilot could ask for in making his first cross-country. Quite likely, the students, two ensigns, a second lieutenant and a Nav-Cad, were looking forward to a welcome change from the routine of formation tactics which comprised much of the basic tactical syllabus. They averaged about 130 hours total flight time.

For the instructor, the flight was perhaps merely another in a series of identical trips over the same route with other students. Today's flight promised to offer little new to add to his 2300 hours of squadron and instruction experience.

Augmenting a previous hour-long, cross-country lecture, the preflight briefing at 0645 had been routine and complete with weather and emergency procedures. Flight planning and filing had been checked by the instructor, and each student carried a carefully folded sectional map showing the track and checkpoints. (The instructor had not drawn in the course line on his WAC chart).

Then the pilots moved out to the long double flight line of yellow-painted SNJ trainers to man their respective airplanes. About 0830 the flight taxied out and, with the instructor in the lead, took off, making a running rendezvous as they climbed 3000 feet.

When the flight was joined up the instructor passed the lead to the First Student, who took a firmer grip on the stick and settled down on a course of 299 degrees, 130 knots. (The Fourth Student's compass was reading about 315 degrees.) The wingmen moved out into a scouting line formation and the instructor dropped back to a chase position astern. (There was no compass correction card in the instructor's plane).

About 40 miles out, the flight passed a large city, easily recognizable, and some 15 miles farther all pilots identified a large lake located a few miles to left of course. Checkpoints thereafter were less readily identifiable and occasionally subject to some doubt when later discussed.

The first leg of 123 miles was covered in about 65 minutes, with checkpoints appearing about as anticipated. Nearing a medium-sized town, which they considered to be the terminal point of the first leg, the First Student gave a zoom signal to join up the flight and to pass the lead to the Second Student.

Leading off on the second leg, on a heading of 315 degrees (the Fourth Student's compass again differed somewhat) the Second Student "was fairly sure of my checkpoints and seemed to be on course" for the first half of the leg. Any initial doubt he may have had was resolved when he sighted a first checkpoint as scheduled.

About this time the instructor tuned in the destination radio range to insure that the flight was not straying to the left of course and across

Observing that the field was becoming crowded, one student pulled up over the highway to land in the adjoining field . . .

The Fourth Student's slideout carried him through two fences and slewed him around facing an outbuilding . . .

the south leg of the beam. (The range legs were oriented roughly north-south, east-west.) As this was the students' first cross-country flight, they had received no instructions in the operation or use of the low frequency range receiver.

Receiving a bi-signal, the instructor assumed that the flight had indeed drifted to the left, or west of course, and he ordered a course change of 10 degrees to the right. Some 15 minutes later he directed another change, 15 degrees to the right, and as the Second Student put it: "after a few minutes on this course I was no longer sure of my checkpoints, but thought I was on course. So I continued, looking for landmarks . . . " This confident assumption was further supported a few minutes later when the instructor ordered the flight to "balanced parade, open canopies and maps away."

As later reconstructed, the instructor actually was receiving the bi-signal of the east leg of the range and hence merely aggravated his situation by attempting to orient with respect to the south leg.

"About this time," he says, "the low frequency receiver malfunctioned to the extent of no signal. We continued on a heading of 330 degrees." A short time later, when the radio was again functioning properly, the instructor was hearing a clear "A," confirming that he had crossed the beam into the adjacent quadrant. By now the estimated time of arrival at destination had passed, and it was not yet in sight.

Some 15 minutes past ETA the instructor asked the student leader if he knew where he was. The leader did not. Nor, apparently, did the other three students. But, probably because of the presence of the instructor, there was little or no uneasiness among the students.

Noting that he had 40 gallons of fuel remaining, the instructor surmised that the students "had somewhat less." Pulling out a radio facility chart from the map case, the instructor looked for the appropriate page having the destination radio range information, only to find that the page "had been neatly removed." This discovery automatically relegated to lesser importance the fact that the RFC was some 9 months old.

The instructor then referred to his sectional chart having the radio range thereon, and began a fade and build orientation. However, "due to my difficulty with the map and low frequency volume control, this took about twice as long as usual." During the orientation power settings were reduced somewhat to conserve fuel. By now, a certain amount of perplexity was no doubt experienced by the students, for as the student leader recalls: "After several heading changes, in a general triangular pattern, I lost track of time on each leg, and the fuel reached a state of less than 10 gallons in each plane . . . "

The instructor continued his solution of the problem. "When I finally determined I was in the northeast A quadrant," he states, "we turned to a heading of south to intercept the east leg and ride it

Continued next page

in." Now, however, the students began reporting low fuel states. Observing the rough, swampy terrain about him, the instructor concluded that there were few suitable spots in which to land. So, "when the lowest fuel state reached 5-10 gallons, I made the decision to put the flight into the best available field." Power settings were further reduced.

Then off to his left there appeared a small town, with reasonably level fields. The instructor had climbed once to 5000 feet to broadcast a *Mayday* on several channels, and, receiving no reply "assumed we were about 40 miles from destination, and whereas I might have made it, the others certainly would not."

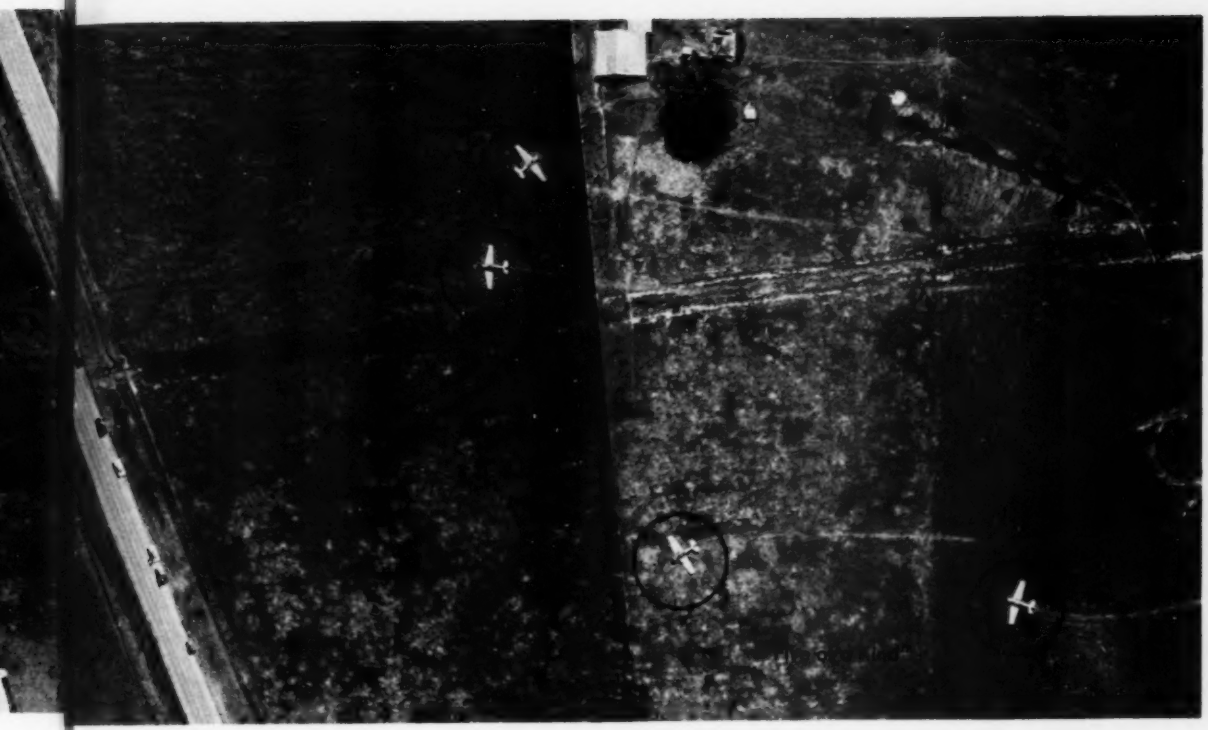
The instructor then dropped down ahead of the flight to select a field, advising the flight that "we're gonna have to land in a cornfield; tighten shoulder straps and belt; land flaps-down, wheels-up."

For the first time, to at least one student it was now apparent that the various turns and headings flown were *not* a part of some kind of entry procedure to the destination. Similarly, the Fourth Student "thought the instructor was kidding," until he rechecked his gas to find it down to 10 gallons.

Having selected a field, the instructor placed the flight in a regular echelon, directed them to watch him closely and to do as he did. As the instructor made his approach the students followed in a loose, triple interval column.

As he neared the field of his first choice, the instructor pulled up when he observed water standing in the field. Continuing to the next of several fields which lay in a straight line, he touched down and slid considerably less distance (about 150 yards) than he had anticipated, and slewed slightly as he came to a stop. He had 15 gallons of fuel remaining.

The student leader of the second leg followed, the pilot recalling that he was quite confident of making the landing successfully. A crosswind momentarily caused him to drift towards a couple of pine trees, but he banked to avoid them, leveled and hit, slightly power-on and flat. He slid about the same distance as the instructor, slewing slightly, and got out with no difficulty.



He had five gallons of fuel remaining.

The Fourth Student, recovering from his initial surprise on discovering he was really participating in an emergency landing, also found it necessary to correct for a crosswind which pushed him toward trees and then a ditch. However, he managed to avoid both and made a normal touchdown. He recalled that "I felt like I was driving a train down into the field." The feeling was not entirely without cause, apparently because his slide-out carried him through one fence, then a second fence which slewed him around to rest facing an outbuilding quite near.

The Fourth Student then got out of his plane, and observing another plane approaching for a landing, moved out to wave him away from the ditch. It then became obvious that the airplane was headed directly at him, and the fourth student discarded any ideas he may have had about giving landing directions and scurried out of the path of the landing airplane. The fourth student had six gallons of fuel remaining.

The next man to make an approach went over his landing checklist "doublechecking that my gear was UP." Noting the plane ahead of him sliding sideways on landing, and "believing that the field was not large enough for another plane," he popped flaps and added power to balloon over the wires bordering the road. He landed on the next field, secured switches and left the plane. (He returned later to check the plane secure and to lock the controls.) He had seven gallons of gas left.

The last man to land had gone around on his first pass, and now he set his plane down between the instructor's plane and another. Seven gallons of fuel remained in his tanks.

There was no injury to any of the pilots. Each airplane sustained class Charlie damage.

When the doctor-owner of the farm arrived, he expressed his relief that no injuries had been suffered in five landings. Only later did it become evident that there was a matter of an exceptional stand of special and rather expensive hybrid oats, which had suffered considerably during the landings . . . •

The pitot tube with which *Les Engineers Aeronautiques* provided the *Spads* of yesteryear, and which yet remain with us, are no longer adequate for the jet age task—so, pilots, prepare to . . .

Assume the Angle

For poor Henri Pitot please shed a
tear
His pipe in the wind pilots once
held dear
But mach these words, airspeed's
passé
Angle of attack is here to stay.
—*Anymouse*

Now, before any indignant members of the Ancient and Loyal Order of Airspeed Clock Watchers are moved to protest this unseemly treatment of their favorite instrument, permit us to explain.

As has been inscribed atop Kill Devil Hill, in the beginning there were Orville and Wilbur, who, with only a few of the basic principles of flight available, managed to complete the world's first Flight Schedule. In the years immediately following, scientists and engineers got into the act and figured out *why* they could fly. There was this wing, see, and this propeller thingamabob pushed the wing through the air and kept you up, see? If you moved the wing through the air fast enough you were an aeronaut, with an enviable future. If you didn't keep the wing moving through the air fast enough, you were an aeronaut with no future at all.

This shrewd philosophy was based on an early interpretation of what we now refer to as the basic lift formula, which of course, you remember from ground school as being: Lift equals coefficient of lift, times half the air density,

AAI installation in *Fury* cockpit shows location of instrument.

times velocity squared, times the area of the wing, or:

$$L = C_L \tfrac{1}{2} \rho V^2 S$$

WHERE:

L = Lift
C_L = Coefficient of Lift
ρ = Air Density
S = Area of the Airfoil
V = Velocity

A very neat package, this, and one which permitted a little advance planning when, say, a Mark IV *Spad* design was contemplated by BuParis. On such occasion, *Les engineers aeronautique*, with an understandable curiosity as to whether their brainchild would get off the ground, would proceed so: They could assume an approximate weight that had to be equalled by the lift in the formula; they knew the area of the number of wings they planned to put on the new machine; they knew "Rho over 2" to be an air density factor controlled only by Mother Nature. So, to solve the formula, what else could they measure? *Quel* indeed!

Because their general knowledge of coefficient of lift was about as complete as Ben Franklin's relationship between lightning and electricity, they concluded that to solve the lift formula they must enter a factor which would remain constant. This they obtained from the wind tunnel tests of the airfoil and wing shape selected. Over on the right side of the formula there were now two factors to play with: C_L and V^2. Of these two, the one to worry about, the V^2 part, was simple—everybody knew velocity was speed, and speed could be squared. So, measure velocity, provide for enough of it, and *Voila!* You're airborne! There remained only the little matter of providing the pilot with an instrument with which to measure this airspeed. Casting about for such an instrument they spied the gadget which M. Pitot had provided to measure the flow of water in the sewers of Paris. Modifying this somewhat, they stuck a pipe into the wind, and by subtracting static air pressure from the Pitot pressure, they got a differential that could be measured as miles per hour. *Sacre Bleu!* This little instrument, which *pilotes chasseurs* affectionately called "l'doozee," became something to swear by, and as a flight instrument, was second only to the seat of the pants indication in reliability.

Time passed. World Wars Once and Twice came, and airplanes grew in size and speed and complexity, but always and ever, each new airplane came equipped with its faithful pitot tube and airspeed indicator.

The pilots were content.

Then, with an ear-bending roar, came the Jet Revolution, and as the inventors and engi-

neers got way ahead of the times, the conventional thinking citadels were toppled by screeching, sweptwinged hurry-birds whose performance required terms such as "speed of sound" and the like. This we know and accept. What we have not so quickly perceived in the appearance of these flying smog-pots, is the increasing inability of the faithful pitot-tube-airspeed-indicator to cope with the situation.

Two things have happened to the pipe in the wind in the jet age. First, at mach speeds, a shock wave forms around the pitot tube head and static source, and "Velocity Squared" becomes something less than accurate. Secondly, with the sweepback on the wings and the resultant nose high landing attitudes of the new jets as they slowed down to land, they got so "cocked up" that the pipe was no longer *into* the wind nor was the static source uncluttered, and hence, accurate measurement of the wind over the wing was impossible.

In short, with V^2 wrong at both extremes of the speed range, the pipe in the wind is becoming *passé*. The airspeed instrument is passing from the realm of a primary flight instrument to the role of a navigational instrument — speed times time equals distance.

So, you inquire, now that we are no longer hoist by our own pitot, so to speak, what occurs? The answer is so simple and encouraging as to make you wonder why it was not available for the Mark IV *Spad*.

Citizens of the cockpit, meet the best friend a pilot ever had —the Angle of Attack Indicator. Get to know this gadget real intimate like. Cultivate this little jewel of the jet set and it will be a mighty source of information and comfort.

And now that the formal introductions are over, let's take a look at the pedigree of this new member of the cockpit instrument family. Take another glance at the magical formula, and remember that

$$L = C_L \tfrac{1}{2} \rho V^2 S$$

WHERE:

L = Lift	S = Area of the Airfoil
C_L = Coefficient of Lift	V = Velocity
ρ = Air Density	

"L" in the expression is Lift, and without enough of that, the airplane loses all interest in flying. Remember too, though, that the man in the cockpit has to know this information because if there ain't enough lift, the machine will stall. Now the Rho over 2 we mentioned before is in Ma Nature's hands and we can't control *that*. The "S" we can't do anything about either, except maybe drop flaps, which isn't the answer we want.

So, out of the five terms in the expression, the pilot winds up with only two terms which he can do something about in the cockpit. They are V^2 and C_L. But V^2 depends on that pipe in the wind for its measurement, and that goes to pot in today's supersonic speeds and high angles of attack during landings—both of which

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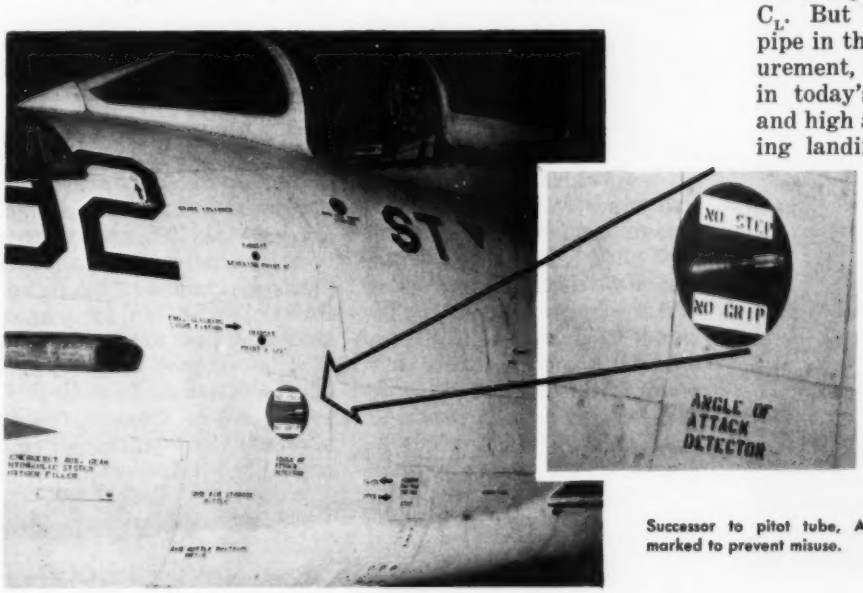
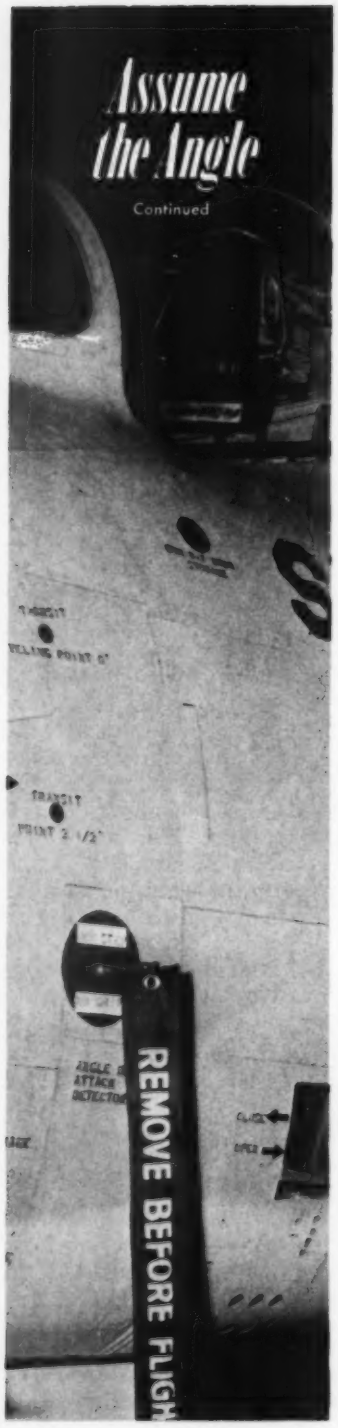


Successor to pitot tube, AAI static probe is well-marked to prevent misuse.



factors make this gadget something less than completely reliable. Still, before you got the little AAI jewel, there was nothing in the cockpit to measure the other term C_L, in order to do something about *that*.

So now we propose to call V^2 something we can't do anything about because our measuring device is inaccurate. That leaves C_L sticking out like a sore thumb as the best term to measure — and by measuring angle of attack we get the C_L being produced.

The angle of attack indicators, as installed in jet fighters, permit a new entry into the lift formula, namely: C_L. The AAI presentation gives a direct reading of the angle of attack, or the direction of the relative wind with reference to the wing, which is accurate throughout the speed range of the aircraft. The AAI also gives the pilot performance data that was only approximated before by the airspeed reading. With knowledge of what you can do with the readings of angle of attack, you're going to wonder how you got along so long without it.

First, the angle of attack is the angle between the chord line of the airfoil and the relative wind. Wind tunnel tests give us the data for the airfoil and wing plan shape, from which we draw Fig. 1, which is a single simple curve. This curve is independent of the operating weight of the airplane, airspeed, and the altitude factor. Hence, the angle of attack for such things as maximum endurance, will be the same, whether you're lugging a full fuel and ammo load or nearly bone dry, and the altimeter can read anything between the ground and the service ceiling. Similarly the angle of attack for maximum G in maneuver will remain the same for all load conditions and altitudes. The angle of attack for stall will remain the same regardless of loading or altitude conditions. Sound interesting?

Let's consider the angle of attack for stall. In Fig. 1, which is a typical diagram for a laminar flow, high-performance airfoil, we show C_L Max at an angle of attack of 25 degrees. When the indicator in the cockpit reads *that* value, the airplane is ready to get away from you, regardless of what attitude the plane is in or where the nose is. You can be in a climb, on your back on the top of a loop, or in a high G nose-level turn—the instrument couldn't care less. It is merely informing you, Buster, that if you plumber around until the angle reaches 25.1 degrees, you will get a chance to practice your spin recovery technique.

In high lift wings like an R4D (Oh yes, cousin you're invited too. Stalls are about the most democratic things known—they'll happen to anybody!), you could be a couple of degrees beyond C_L max. before the plane would flop off—that's because old-style, high-lift airfoils have a C_L *vs* angle of attack curve that is very round on top. The wing would be stalled but still producing some lift. But, *don't* try it in

No barnacles, please! Loving care is recommended for this jewel of the jet set.

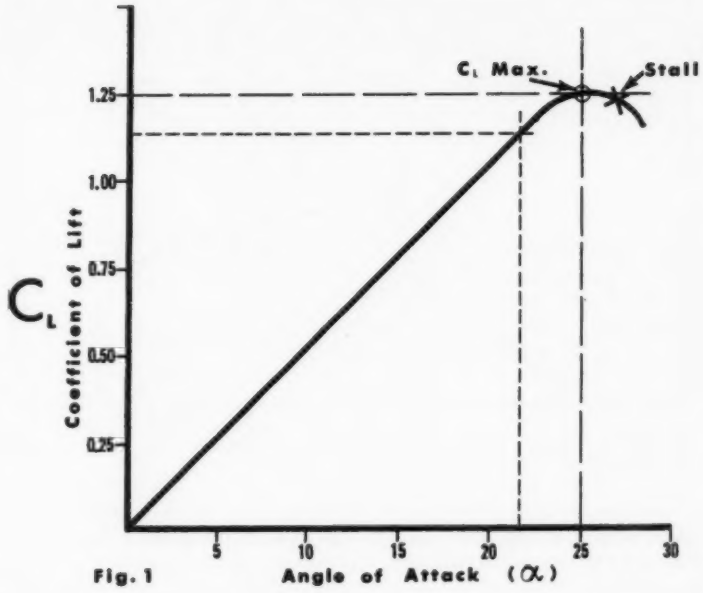


Fig. 1

a jet fighter!

There's a rumor going around the place that some of you jet gents have the AAI instrument in your planes, but don't believe in them as yet. If you're inclined to regard the AAI as a sort of newfangled dingus, we don't even ask that you take our word for it. Here's how to prove to your own satisfaction that they work, and incidentally, you can check the calibration at the same time. It's perfectly painless, and can be most enlightening. Look at the setting of the index on the AAI gage in the cockpit. The Pax River folks set *this* for best CV approach, based on a safe percentage of C_L max.

On your next flight, when you're at a comfortably safe altitude, wrap up the old buggy into a high G turn and hold it until you feel the onset buffet of an approaching stall. (Make sure this is stall buffet and not compressibility buffet due to mach.) Then as you ease off, look at the indication on the angle of attack dial and see if it isn't just what the Pax folks said it would be. You can also check the indication against the published handbooks' stall angle and speeds for that altitude. Try a power-off approach to a stall and see if the reading isn't the same. If you don't get the published reading for a stall, have the installation checked when you're back on the deck —you'll probably find that something's out of whack with the probe—like somebody using it for a handhold or a hatrack, or maybe it's fouled up with dirt and corrosion. *That* problem you can lick with a little education of the ground folks regarding the probe.

You have just learned the quick, easy way to see how far you can go in the performance of your airplane. When you are horsing around in a dogfight—and *that* sort of caper will be regarded as somewhat stupid by multi-mach drivers —and you reef it in to shake off the other gent—hark. There ain't no need to keep it shuddering around in the buffet zone, just reef her in until you get an AAI reading just a little below C_L max, because at *that* angle of attack you're doing the very best you can. This is true regardless of max rate or max radius of turn.*

Now, while this stall-checking doesn't necessarily qualify you as a TPT graduate, it should convince you that you've really got something in this little dial. It should bring to mind another ve-er-ry important use to which the AAI can be put.

Whazzat? Why, sure! Landings! Remember we said there's a Pax River angle of attack set on the index on your gage for best CV approach? *Set that angle and hold it with the stick* (this will give you the airspeed which is appropriate for your weight); *use a power setting which will give you the rate of descent you want, and you've got the best approach that's built into your machine.* By visual reference you'll determine if you're high or low, and just as you were taught long ago, you'll control your altitude with *throttle*, and *Ipso Facto* LSO, you got it knocked.

If you decrease the angle of attack in the straightaway, you'll land hot and a little

Continued next page

*There's always a joker, and in this case it's compressibility effect. These effects can change C_L max and angle of attack for stall in the transonic and supersonic ranges.

Assume the Angle

Continued

short. If you increase the angle of attack, you'll increase your rate of sink and land hard and a lot shorter.

Suppose on your test flight of the instrument, you found stall way off and gone from what it should read. So do you kick the dial in the face and stomp off to recommend removal of all the things? We hope not, on account there's a reasonable explanation.

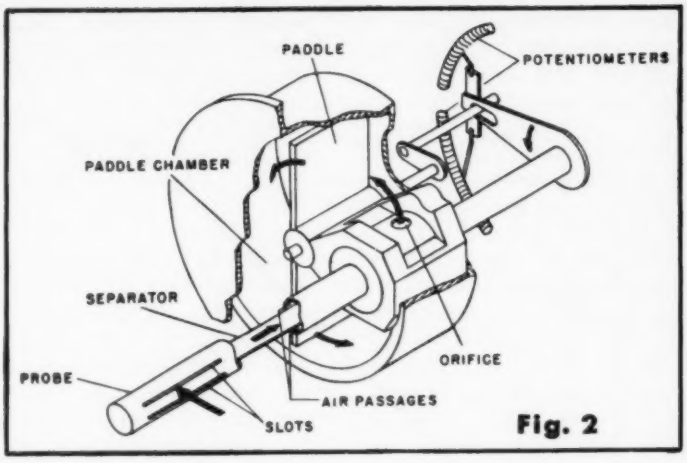


Fig. 2

Air pressure from slots of AAI probe is directed to paddles which cause probe to rotate into the wind.

If you'll look at Fig. (2) you'll notice that the probe of the AAI indicator is a little metal, pencil-like thing having two slots in it. Now the pencil, by itself, won't rotate to stay faced into the airstream to give you the accurate reading you require. So the engineers arranged to bleed air pressure from the slots to push some paddles which turn the pencil slot back into the airstream. As one slot is moved out of the windstream by the up or down attitude of the airplane, pressure builds up on the paddle to rotate the pencil back until both slots are receiving an equal amount of air.

Obviously, that sort of sensitivity (about $6000 worth per installation, fellow taxpayer!) can't be bashed about or allowed to collect barnacles, but a reasonable amount of care will guarantee the very best of accuracy for the very best of folks—*you*. So speak to the people concerned and advise 'em that you and your dependents will appreciate the finest of loving care given to your airplane's equipment. Buy that?

The gadget can be used for many other things, such as max endurance, max range, best power-off glide, best climb. . . . The joker being where can you get the information concerning the angle of attack to be used for each of these conditions of flight. Some handbooks specify these angles of attack, some do not. Some aviators understand the concepts; others need just a little more booklearning. Combine TPT grad knowledge, safety officer course info, tech rep information and any dope available in your handbooks, and get a Dilbert Tech started in your outfit. Who knows, you might come up with the sharpest bunch of drivers since the Top Hatters.

You, in turn, can maintain your active status in the Pilots Mutual Protective Union by entering any and all discrepancies on the yellow sheet, and by following through on the squawks noted.

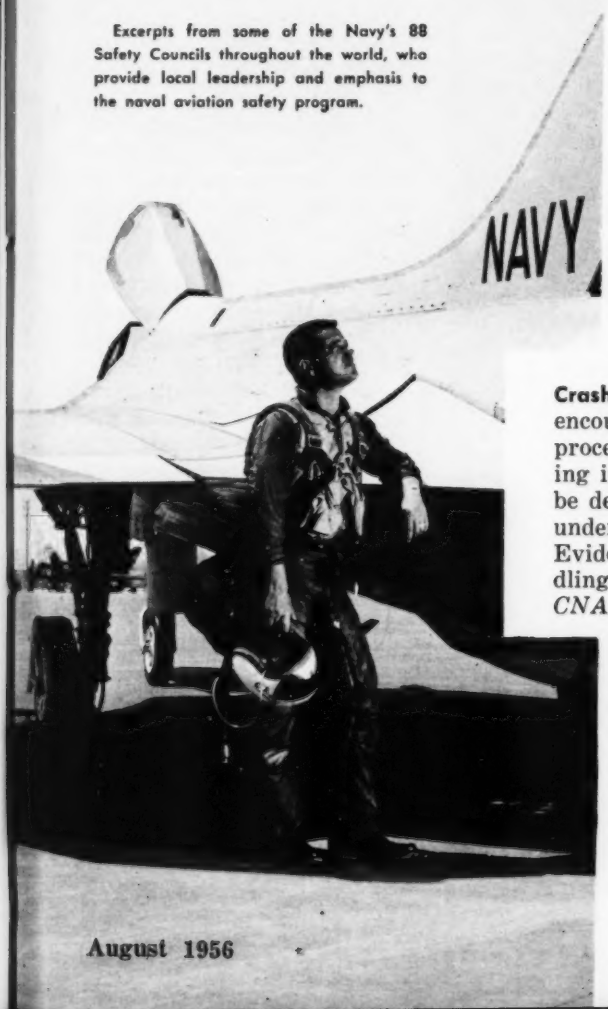
With all of the things angle of attack will tell you, it's well worth your while to make sure your plane has one that operates. It will help you be tomorrow's professional aviator instead of yesterday's pipe in the wind pilot!

For more info with pictures, draw training film MN-7899A and see the testing and operating techniques. The title of the movie is, of all things, "Angle of Attack Indicator—Introduction."

Passenger In-Flight Reading Material—Copies of *Approach* magazine have been obtained from NASC for distribution to passengers during flights in the same manner as magazines on board the commercial airliners.—*ComFLogWingLant/Contl.*

Safety Council Notes

Excerpts from some of the Navy's 88 Safety Councils throughout the world, who provide local leadership and emphasis to the naval aviation safety program.



Releasing Information to the Press—A requirement exists to provide the PIO or Information Service Officer with immediate data concerning an aircraft accident or incident. This will allow those officers to release to the press correct material and thus help avoid the publication of erroneous information.—*1st MAW*

Safety Proportional to Command Attention—The Aviation Safety Council took cognizance of statistics that definitely prove the accident rate is affected by the degree of command attention. That is, when the commanding officer and the executive officer are safety conscious and are carrying out a definite safety program, the safety record responds to it. It may not respond in a week, in some cases it may not respond in a whole month, but over a long period of time it does respond!—*CNABaTra.*

Crash Investigating Team Concept—Safety Officers are encouraged to assemble a crash investigation team to proceed to a crash, rather than each member proceeding independently. It has been proven that more can be determined at the crash scene if the team concept under the direction of the safety officer is utilized. Evidence is less likely to be hidden or lost by mishandling, inexperience or early removal of wreckage.—*CNABatra*

Timing of Radio Transmissions—Tower transmissions are being made to aircraft during the critical stages of landing or takeoff. It was recommended that tower operators be instructed to delay routine transmissions until after the aircraft had either landed or become airborne.—*Whidbey Area Consolidated AvSafCouncil*

ANYMOUSE and

IT COULD HAPPEN TO YOU

"From my office window I observed an FJ on very late final with no gear. A mighty blast was heard and he labored back in the air after avoiding a wheels-up by only inches. I chuckled to myself and wondered how a guy could ever forget a thing like that. My theme song these days is 'It Could Happen to You' as you will see it did from my tale of woe.

"Just 2 short weeks later I was flying copilot from the right seat of a P2V on a GCA approach to home base. GCA instructed us to go through our cockpit landing checklist, which we did. I sighted my wheel down-and-locked as did the pilot and the plane captain. GCA then informed us we would have to wave off at 1 mile to set up for the runway opposite to the GCA runway. This we did and unknown to me, the pilot retracted the gear. At the 180-degree position I called the tower, reported at the 180 with 'gear in the green.' The tower requested we recheck gear and cleared us to land.

"As the pilot began his flare-out it gradually dawned on me that the aircraft was unusually low to still be flying and not touched down. About 1/1000th of a second later I spied the difficulty, the gear handle in the UP position. About the same time, two 3350s roared in the night and the P2V attached to them paused, shuddered, defied the attractive gravity and regained the air, but not before an ominous scraping sound was heard. Safely back in the ozone the aircraft was checked and all appeared normal, so another 'normal' approach and landing was made without incident.

"Once on the line, it didn't take a very scrutinous eye to see the ¾-inch missing from 4 blades of the port prop and a well scraped and stove-in radome.

"This came as a mild shock since my name was scrolled on the Part Able. The accident board had many ideas on the subject, but mainly, the fact that the pilot (normally the copilot in the crew) was flying from a position he was unaccustomed to. Likewise for me. As for me, I can sum it up with a well worn, but appropriate, phrase like 'heads down and locked; wheels up and locked.' "

his hairy tales

Anymouse reports are submitted by Naval and Marine Corps aviation personnel who have had hairy or unsafe flight experiences. As the name indicates these reports need not be signed. The purpose of Anymouse Reports is to help prevent or overcome dangerous situations. Forms for writing Anymouse Reports are available in ready rooms and line shacks. All reports are considered for appropriate action. Send reports to the Naval Aviation Safety Center, NAS, Norfolk 11, Va.

CURRENT STORY

While flying on top of a solid overcast in a TV-2 Anymouse experienced radio failure accompanied by complete electrical failure. His destination was NAS Glenview which was last reported IFR with a possible change to VFR in the next half-hour.

With a complete loss of electrical power Anymouse had no radio equipment, no gyro-horizon or directional gyro, and he couldn't transfer fuel from the leading edge tanks.

"Available fuel was hastily computed" said Anymouse, "and I attempted to navigate on my available compass, hoping Glenview would go VFR. Without an intercom I was unable to brief my passenger for ejection in case of flameout, but he had been previously instructed to go as soon as the lid was off."

Anymouse broke out 75 miles north of Glenview on the west shore of Lake Michigan and started an idle descent to the field. Unable to receive or transmit he broke over the runway and started his approach. He put his gear lever down and got a green light from the tower. At that point his troubles multiplied. Without electrical power he had no flaps or speed brakes.

"I was hot and high" Anymouse quavered, "I made a fast touchdown half way down the runway with a fence and highway coming up on the end. I had to go around, not knowing how much fuel I had left. Got another green light and knew I had to make it this time.

"I did, but the fuel truck operator said there was about five gallons remaining in my fuselage tanks and the tip-tanks were empty!"

Full information on electrical failure in the TV-2 is contained in the flight handbook Section III, page 106 (TO–1T–3A–1).—Ed.

VS DIVEBRAKES

"Taking off in an S2F at about 60 knots I had to change the normal tab settings by adding 5 degrees right rudder and 4 degrees nose-up. The plane handled normally after retrimming and I had only a 15-minute flight to NAAS Brown Field so I didn't abort the hop.

"Over Brown Field I made a normal break and lowered the gear. Had to crank in 2 degrees more right tab. At the 180 I came back to 15 inches power settings.

"I was over the LSO's platform at about 75 feet, 95 knots, with 15 inches. As I started to flare and reduced power to 13 inches the stick shaker cut in and the plane started to stall about 25 feet in the air. Power up to 30 inches was added to regain airspeed and I held the aircraft just off the runway, chopped power and dropped her in. I touched down at about 90 knots.

"I taxied to the line and when I went aft to get out of the plane, I didn't have to do anything. The door was open and the ladder was rigged in place. It had been that way all through the flight."

JOURNEYMAN

Anymouse said, "after angling off the runway on take-off with resultant nosewheel collapse, I abandoned the aircraft on the right side and ran upwind, possibly 30 feet, then disengaged the parachute and turned to survey my handiwork."

HEADMOUSE

Dear Headmouse:

We thought "Dropchecks Were Not Enough," page 39, February *Approach*, effectively illustrated the dangers of recycling F2H gear components once indicated DOWN and LOCKED. Revision –3 dated 1 July 1956, of the F2H-3 Pilots Handbook concerning emergency operation of the landing gear requires recycling all gear.

Do you have any additional information as to why procedure has been revised?

—Anymouse

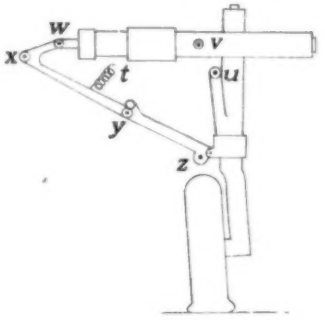
The reasoning behind this procedure is that: (a) An F2H main landing gear which had been lowered by the emergency method has never been known to collapse. On the other hand, there have been numerous accidents involving landing gear which have been lowered electrically in the presence of erratic or inconsistent indications.

(b) It is particularly dangerous to pull the emergency release on an F2H when either of the main landing gears are locked down. This is so because the recoil from the preload on the actuator may be sufficient to spring the side braces slightly out of the over-center lock position. This motion is caused by the sudden release of the landing gear actuator clutch by the direct mechanical linkage. Since this condition will not cause a change in the position indicators, the necessity of recycling the gear becomes apparent.

For a better understanding of the F2H landing gear system McDonnell Aircraft offers the following:

The overcenter position of the side braces is the sole means of locking the main gear in the DOWN position. When the gear is extended in the normal manner, an overcenter spring, plus a certain amount of preload induced by the gear actuator imposes a load on the side braces to insure that the side braces remain in the locked position regardless of the fluctuating loads that are imposed on the gear while landing or taxiing.

When the landing gear is extended under emergency conditions and the handle is left out (free fall) no preload is present in the side braces with only the overcenter spring assisting in



maintaining the overcenter position.

You may ask, what, then, is the importance of preload if the gear appears to be more reliable in the non-preload condition?

First of all, although the gear has been dropped from free-fall countless times, they represent only a small fraction of the number of times the gear is lowered normally. Thus, it could be that the difference simply represents the law of mathematical probability.

Secondly, there is a notable difference between free-fall and normal extension which makes the electrical system suspect when the gear is electrically extended. After free-fall, with the cockpit control handle OUT, no possible combination of an electrical malfunction will cause the main gear to collapse even though the circuit breakers have not been pulled. This is so because the gear actuator motor is mechanically disconnected from the gear linkage. Mechanically, the difference between free-fall and normal extension of the gear involves the position of the cockpit control handle.

In the past, it has caused considerable discussion between the proponents of the handle IN and handle OUT position following free fall of the gear. The following is an attempt to explain the direction of landing and taxiing loads under two conditions: by referring to the sketch on this page it can be seen that the loads are distributed as described below.

Handle IN (normal operation). In this condition, loads on the landing gear during landing and taxiing extend through Z, U and V and apply a compression load on the actuator which tends to unlock the side braces at Y but are opposed by the actuator preload and toggle spring T which applies compression at Y holding side braces overcenter against a load reversal.

(Emergency operation). Reversal loads through Z, Y, and X, which are caused by hard landing and taxiing over uneven terrain which tend to unlock the side braces at Y, are unopposed by the preload resulting in the possibility of causing the side braces to unlock and gear to collapse.

Handle OUT. In this condition no preload exists on side braces, but since the actuator is disengaged, no load can be transmitted from W to X such as normally occurs during landing and taxiing with handle IN so that reversal loads tending to unlock the side braces cannot occur.

The conclusion to be drawn from the above two conditions is that it is actually detrimental to the security of the gear in the down position to reengage the control handle after the gear has been lowered on emergency.

Following an electrical exten-

sion of the gear, a variety of electrical malfunctions can, and have, caused inadvertent retraction. For details on this matter, please turn to Maintenance, page 44.

Very resp'y
Headmouse

Dear Headmouse:

I have read many reports identifying causes of wheels-up landings, and have yet to find listed what I feel is the primary cause —poorly designed checkoff lists. After being interrupted in completing the checkoff list, the pilot receives no information on which items he has completed. The present checkoff lists never say to the pilot, "Here I am Landing Gear (or flaps, etc.) still not down." This type of stimulus is needed, and could easily be provided by redesign of checkoff lists. If each item had a hinged or sliding cover, the pilot could "remove" the item from the list as he completed it. Then a final glance would show any items still "outstanding," or a blacked-out list would indicate the check-off list was completed. (The present design never tells the pilot this.)

A provision could be made so that uncovering any single item would expose all the items on the list, theoretically ensuring that the pilot would go over the entire list on go-arounds.

We'll never have a perfect system, but the existing design of checkoff lists has a built-in booby trap. Ask any psychologist whether the present design produces a desired—or acceptable stimulus.

—Anymouse

Like the man says, we may never have a perfect system but the existing design of checkoff list has a built-in booby trap and our psychologists agree. They also informed us that a device very similar to what you'd asked for is presently being evaluated. We feel it looks good especially after all of the Rube Goldbergs that have been developed for the prevention of wheels-up landings. The instrument as presently designed looks like this—(see photo). Credit for the development of this device goes to

Training Devices Center.

Very resp'y
Headmouse

Region of Reverse Command

Sir:

In Headmouse, April *Approach* an FJ-3 squadron safety officer asked "why the Flight Handbook recommends using a 150-knot deadstick glide with wheels and flaps down when his experience indicates that this is not the minimum power-required speed."

For the clean configuration the handbook recommended glide speed of 200 knots is approximately that which will give the most range. For the landing configuration the handbook recommends 150 knots but it does not state that this is the speed which will give the maximum glide ratio.

This recommended approach speed is actually a compromise between two important factors. First, as slow speed as possible is desirable in order to minimize the landing rollout. Second, the approach speed must be high enough for controllability and, most important of all, to flare the airplane from any reasonable rate of descent. An approach speed of 150 knots was found to satisfy all these requirements the best. The maximum range glide speed or the minimum power required speed in the landing configuration is admittedly somewhat slower.

. . . the labels on the two rate-of-descent curves on page 56 of the Flight Handbook are switched . . . This error has been reported and should be soon corrected.

R. K. AWTREY
LCDR, USN

Dear Headmouse:

I feel you've missed the real reason the handbook lists a speed in excess of L/D max. for "Maximum glide with gear and flaps down."

First, the speed at which L/D max. occurs as shown on your plate (Figure 1) is the width of a pencil line. While it is possible to fly hypothetical airplanes with such precision, it is not feasible nor practical to attempt to do so in the air. The reason any disturbance or bank immediately places you on the "wrong side" of the curve and an increase in RPM is then required to hold a stabilized speed on the "hooked" portion of the curve. Stabilization in this range is extremely difficult to attain.

In the actual determination of this speed (and as an accompanying result, the max. endurance speed) it has been the policy to use the minimum thrust speed of the curve only as a starting point and then qualitatively determine a speed above this point which will allow for shallow banks and light turbulence without decreasing speed to that at which the "Reversed Command Regime" is encountered. This increment is always added to the minimum thrust speed. For this reason, a check in the air will not show the max. end speed or "speed for maximum glide" to be the same as that of the minimum thrust speed.

It is true that to stabilize in at a slower speed in the "hook" requires more thrust if a constant altitude is maintained. It does not follow however, that adding thrust in this condition causes the airplane to slow down. The last was added for "yuks" but I have heard the point argued both ways with great conviction.

Out-House-Mouse

Truth and Consequences

A DIGEST OF SIGNIFICANT AIRCRAFT ACCIDENTS

When extending their flight the pilots failed to check the forecast and ended up in the soup.

FORECAST FOR TROUBLE — A TV-2 departed a western air force base heading for home on the Gulf Coast. El Paso was a planned fuel stop with an estimated en route time of 2 plus 42. Fuel aboard was estimated at 3 plus 30.

During the hop a healthy tailwind pushed the ground speed to 500 knots and the flight arrived over El Paso at 1856; 46 minutes ahead of schedule. Considering the en route time to home base as 1 plus 20 and fuel remaining at 1 plus 45, a decision was made to refile IFR by radio and continue the flight.

The 1830 sequence report for the home base was given as 1200 overcast with 10 miles of visibility; winds eastsoutheast at 15 knots. Airfields inland were reporting clear with visibility unrestricted.

Thus far the flight seems to have hit one of those combinations of good wind and weather which aviators are quick to take advantage of. However, both pilots riding the TV overlooked two vital points. An alternate was not included in the extended flight plan and no terminal forecast was requested as outlined in OpNav 3720.2. Both pilots had well over 1000 hours but the pilot in the front seat had only 26 jet hours, the pilot in the back seat had 136 jet hours.

Had the forecast been requested here's what the pilots would have found: At the time of refiling over El Paso their home station was forecast to go down to 800 broken with three miles in fog and an hour later was to be deteriorating to an indefinite ceiling of zero and one-half mile in fog.

While at 45,000 feet and about 50 miles out from the home field the lights of the destination city became visible, straight ahead through a thin layer of clouds. About two minutes after sighting the city, the pilots heard a transmission stating the weather as 600 broken with 10 miles visibility. At this time the TV was approximately 8 minutes out. Having the weather, the pilot cut back to idle and started descending.

At 2013 the flight called approach control for a penetration. Approach control advised that weather was 100-foot ceiling, one mile visibility and decreasing rapidly. No acknowledgement for the weather was received and the aircraft was cleared for a penetration as requested. The Navy range station noted that communications were bad between the TV and approach control.

Eight minutes after the initial contact with approach control the TV was in a penetration turn and at that time the pilots became aware that the weather had deteriorated

below range minimums. Control was taken by the rear seat pilot who reported a low fuel state of 80 gallons and requested GCA pickup.

Unfortunately, GCA had not been alerted until 2010 although aerology reported the field below VFR minimums 40 minutes earlier. As a result approach control advised a 10-minute delay for GCA.

The TV made a missed approach and then proceeded to another air station nearby, requesting GCA assistance from that field. Radio contact was made with the GCA unit there but no radar contact was picked up. At low altitude and with 20 gallons of fuel remaining the pilot climbed at 100 percent. When the fuel gage read ZERO the pilots ejected. No injuries were sustained by either man. The aircraft crashed in a deserted area.

PARKING BRAKE CONTROL — Two pilots had scheduled an early morning takeoff in an SNB-5 but were delayed until the aircraft was turned up by the plane captain. Immediately after the plane captain finished, the pilots entered the cockpit, ran through the checkoff lists and started the engines.

After a check of engine instruments, the pilot put his feet on the brake pedals and signaled the lineman to pull the chocks. Power was applied to start the plane rolling. About the time the pilot expected to receive a left turn signal from the signalman he noted that pressure on the brake pedals had no effect.

The pilot gunned his starboard engine briefly to swing the plane to the left. The SNB completed the turn, but the radius was too great. The right wing struck the tail surfaces of a parked SNB. A swerve to the right developed from this impact and the port wing of the moving SNB struck the tail of another SNB. Personnel on the flight line scattered in time to clear the impact area and there were no injuries.

Immediately after the accident the parking brake handle was found pulled out in the ON position. It is necessary to release the parking brake handle on the *Beech* before effective braking action is restored. Failure of the pilot to check the condition and operation of his brakes after the chocks were removed and prior to taxiing was the primary cause of the accident.

ILL WIND — While returning personnel to a destroyer the pilot of an HO4S took station about 100 yards off the starboard quarter of the ship. There had been no exchange of communications and the destroyer did not indicate any readiness for a transfer.

True wind was 38 degrees at 21 knots and the ship's course was 200 degrees at 18 knots. When the helicopter had been on station for about one minute the destroyer began a slight turn to the right. The pilot noticed the turn but mistakenly assumed the change of relative bearing to be from a left turn by the helicopter. He applied right rudder to regain his former bearing and in so turning actually turned almost directly downwind.

At the same time a loss of RPM and rapid settling was noted. The copilot, a more experienced helicopter pilot, took control and attempted to maneuver out of the situation.

However, the initial loss of RPM and altitude had been too great and the 'copter settled into the water near the destroyer.

All occupants evacuated the HO4S without injury and were quickly picked up. One passenger had not checked his lifevest and when in the water found no CO_2 cartridges installed. Also, the crewman had positioned a passenger in the sling prior to the ditching and had not notified the pilot of his actions.

In the opinion of the board this accident was caused primarily by the pilot's inattention to the direction and velocity of the true and relative wind. A contributing factor was the failure of the copilot to instruct the pilot and give him the benefit of past experience, or to take over the controls sooner.

One reviewing authority commented on the accident: "It would appear doubtful if either pilot had had much, if any, experience in flying a small seaplane or sailing a small boat. If they had they would have been aware of the direction and approximate force of the wind almost without knowing how they knew it.

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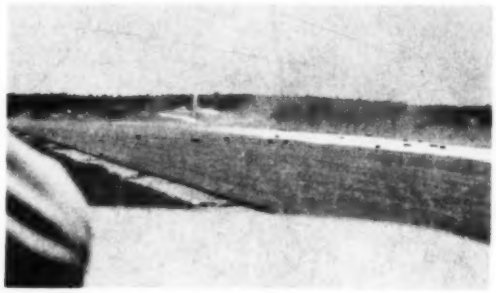
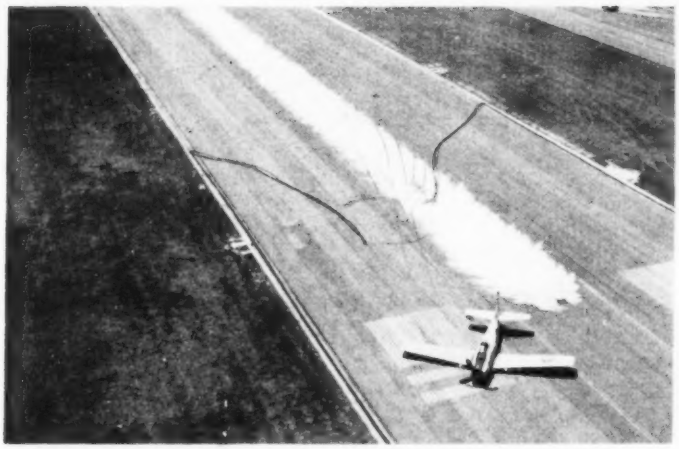
FOAM-ation Tactics

AD *sans* wheels slides to harmless landing on foam strip laid down by crash fire truck. Picture sequence shows manner in which the airplane engaged the field arresting gear and "slud" to a stop with minimum damage.

Alerted to the necessity of preparing runway for AD wheels-up landing, crash fire crew lays foam carpet to "pave" way for field arrested landing.

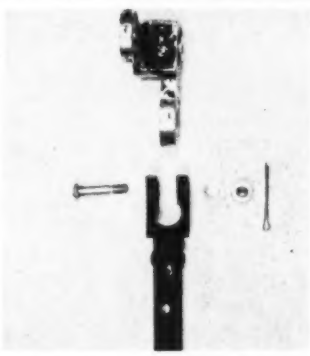


Reading down, (1) AD comes in across boundary on intentional wheels-up approach, and (2) tailhook lowered, nears the field arresting wire to (3) be snared neatly to a stop.



Field arresting wire-chain runout distance may be gaged from position of tire casing wire supports with respect to final stopping point of airplane.

Surprising absence of damage to underside of AD is explained by photo on right, showing airplane resting on miniature bomb rack which absorbed much of scraping effects.



Culprit—causing the accident proved to be an improper variation of this landing gear control linkage wherein an elastic stop nut was substituted for the correct castellated nut-plus-cotter key shown here.

Successfully minimizing the fire hazard, foam also provided lubricant for the skidding aircraft and airframe damage was held to a minimum. Four bent prop blades and a sudden stoppage engine ran the repair bill to $12,420.

Truth and Consequences
continued

STUBBORN ERROR — An AD tow-target plane reported over a task group for work but found he was over the wrong group, and decided to return to his carrier. In anticipation of a tow-target run he had streamed 6000 feet of tow cable. No effort was made to reel in the cable during the return trip.

The tow pilot was joined by his wingman but no information concerning the tow was passed. As the aircraft approached the vicinity of the carrier the wingman became concerned about the tow and suggested several times that it be reeled in. The tow pilot did not acknowledge the transmissions or take any action to eliminate the hazard, merely shrugging his shoulders at the suggestion according to wingman's statement.

Shortly thereafter, an F2H was seen approaching from the left of the two ADs. The jet turned slightly in order to pass behind and below but by the time the wingman broadcast a warning to keep clear the F2H had struck and broken the cable well aft of the tow plane. *"Now* will you reel that thing in?" asked the wingman.

Lacking control of the *Banshee,* the pilot ejected and was picked up minus injuries. The tow pilot stated that after the collision, "I then proceeded to orbit that position and reel in the cable."

The accident board was unable to find any written instructions regarding escorting tows in congested areas in either the squadron doctrine or in any other publication aboard the carrier. However, the board felt that the AD tow pilot was directly responsible for the accident by his lack of interest in considering the safety of other pilots during his flight.

The suggestion to reel in the tow cable was ignored with expensive results.

WHODUNIT—The pilot of an AD was engaged in making night touch-and-go landings. During the climbout, the engine quit, but the pilot bellied it in on the grass within the field boundaries. There was no fire following impact.

The pilot was not injured but did not secure any switches when he cleared the aircraft as it stopped. A member of the station crash crew arriving at the scene reported that he had turned the magnetos, battery and fuel selector OFF, but the accident board was unable to account for the mixture control being in the IDLE CUT-OFF position. Several unknown persons had been observed upon the plane before photographs could be taken of the cockpit controls.

The investigation and subsequent DIR did not determine any reason for the engine stopping. The second endorsee returned the AAR for reinvestigation of the closed mixture control, but it was impossible to determine if the pilot had closed it and caused the accident, or if someone had closed it after the crash.

The sixth endorsement summarizes the investigation of this accident: "It is noted that unidentified personnel had access to the cockpit immediately following the crash. The crash crew should have kept all but unquestionably authorized persons clear of not only the aircraft but also the immediate area of the crash.

"However, it is considered that this does not entirely re-

lieve the pilot of the responsibility, where he is able, to assist or to control the proper security of his aircraft. Crash crew and pilots of this command have been instructed to keep all unnecessary personnel clear of crashed aircraft and that, where the aircraft must be immediately secured for safety, such securing will be done by qualified personnel and will be done with a view towards preserving evidence. This is considered a joint responsibility of the pilot, when he is able, and the crash crew."

The final endorsee adds: "It is of paramount importance that all echelons of commands be reminded that the Accident Report is a vehicle to be used in the search for accident preventive measures, and not for disciplinary purposes or as a reflection on the pilot, his ability, or his unit."

NASC has just had a training movie filmed on this subject titled "Aircraft Accident Investigation," MN-8270; this movie will provide guidance on the proper methods of investigation of aircraft accidents. Approach *will advise when it is available in order that plans can be made to show it to all aviation personnel.*

INSUFFICIENT FAM — A newly designated aviator had 20 hours in the F9F-6 including 16 landings but stated he felt uncomfortable while flying the *Cougar* in landing approaches.

The pilot was number 2 in a section which was landing at a busy west coast air station during late afternoon. He became distracted during the approach by a glowing low fuel warning light and the presence of a multi-engine transport inboard of the two jets. Believing that the leading jet had landed on the right-hand side of the duty runway, the number 2 pilot lined up on the left. However, the leader had landed to the left and thus the new Ensign was lined up on a low macadam-surfaced drainage area which was to the left and parallel to the duty runway.

His approach was fast as he had been in the habit of concentrating on airspeed and sink rate. Speed on final was about 135 knots.

Touchdown was made in the drainage area and the jet bounced three times before sticking on deck. It continued at high speed down the center of the drainage area and upon reaching a 15-degree incline at the end, the nosewheel and starboard main gear sheared. The pilot quickly abandoned the plane after it stopped sliding, failing to secure the engine or cockpit switches.

In his statement, the pilot said his first mistake was in not asking for more bounce landing fam stage. One of the accident board's recommendations amplified this thought: "all aviators, especially newly designated ones, should be impressed with the importance of letting their feelings and doubts be known to their superiors on matters involving unsureness, problems and attitude in order that extra flights can be scheduled."

FIDDLEFOOT—At 110 knots indicated the F3D was ready to fly. In some manner the pilot inadvertently applied brakes sufficiently enough to lock the wheels. After skidding 420 feet the F3D became airborne with both tires blown.

The pilot was unaware of the situation but when the gear was actuated the indicator showed the right main mount DOWN. A check by the observer and two other pilots revealed the right tire missing with the left tire blown. Recycling the gear brought the right main mount up and a radio discussion with squadron instructors followed.

A wheels-up landing was chosen as the best course of action and a 500-foot strip of runway near the approach end was covered with foam.

Touchdown was made in a flat attitude on the foam strip but the plane was slightly fast and it skipped, touching down again near the end of the foam. It stopped 2000 feet down the runway with no fire and no injury to the occupants.

Immediately after the accident both brake assemblies were inspected and determined to have been functioning properly.

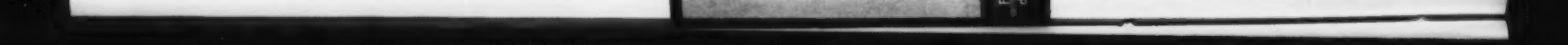
A study was made on the practice of tapping the brakes after becoming airborne and it was found that this need had been eliminated in the F3D with mechanical devices and wheelwell clearances. ●

FLARE NOT

Author Harold E. McDonnell is at present the special assistant to the Chief Engineer of the Flight Test Division, Patuxent River. During WW II he flew P-47s in Italy for a total of 120 missions.

After the war he returned to college for additional aeronautical engineering training, beginning his work for the Carrier Suitability branch of the Flight Test Division of NATC in 1949.

Mr. McDonnell has been involved in development concepts of the angled deck, steam catapult, flexdeck and other innovations developed in the Navy's conversion to jet operations. His article on landing techniques was generated from the recent USS *Forrestal* trials.



"Just head it for the spaghetti and relax! That's the way to get them all aboard. It'll be easy on the airplane structure and on your back."

"Do you mean you recommend diving for the deck?!"

"Definitely not! Diving for the deck is still the best way to 'cream' the airplane. We're talking about the second best way to clobber it. That is, holding off and flaring. To make a good carrier landing, you've got to lower the nose so you're near the static ground attitude when the hook picks up the wire. The thing you want to avoid is a flare."

"Suppose you're on the mirror?"

"Don't flare the landing no matter what kind of tricks you used to get over the ramp!!"

F4D approaching ramp on paddles. Attitude decrease necessary prior to touchdown.

F4D passing over the ramp during a mirror landing approach. Attitude should be decreased slightly after airplane passes over the ramp.

The F4D has an extreme nose-up attitude in the carrier approach. Care is required to properly lower the nose of the airplane to a good landing attitude. This picture shows the airplane approaching a fair landing attitude.

That conversation sounds like something you'd expect to overhear in a psycho ward instead of the Naval Air Test Center. But don't flare the new ones is the word that's going around among the "hot rocks."

The Flight Test Division of the Naval Air Test Center has recently taken the Navy's new stable of carrier aircraft aboard ship. The sea trials were conducted on the USS *Forrestal*. The airplanes were the F4D, A3D, F3H-2N, F11F, F8U, FJ-4, FJ-3 with wet leading edge, and the 8M version of Ye Olde Faithful F9F. The sea trials included the determination of minimum catapult speeds, conventional paddles and mirror landing approaches and flight and hangar deck handling. In general, the carrier suitability task was to determine how the flying machines will handle as carrier aircraft. If there are going to be troubles operating them from a carrier, the job is to find the trouble and recommend a fix.

Naturally, a plane can't be flown aboard a carrier without a great deal of preliminary work. During these shore-based tests, the pilots are consciously and unconsciously comparing the new planes to all other types they have flown aboard.

The pilots of the Flight Test, Carrier Suitability Branch average better than 240 carrier landings per man in models ranging from single-engine prop jobs to twin-

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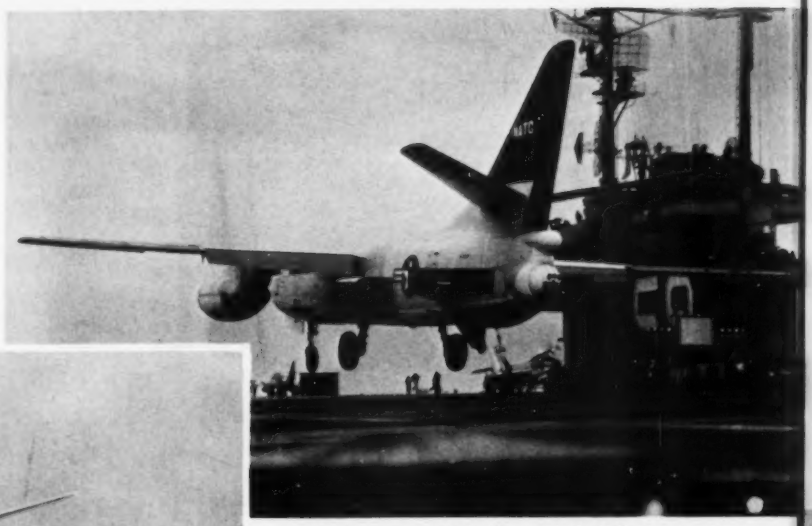
FLARE NOT

Continued



A3D shown in good landing attitude following a mirror landing approach.

Airplane attitude on this landing was good but sink speed was very low. The result was the nose-down pitch as the hook picked up the arresting gear.

engine jets and buzzing turboprops. In addition, they hold separately and collectively every prejudice and misconception that a well-qualified Navy pilot can nurture about carrier operations. Each one brings into his opinion, a widely divergent fleet experience and defends his position with a skill born of long cruises. When they are of one mind, it is something to behold, and it is on non-flared carrier landings that they are with one voice speaking out.

The new crop of airplanes don't land on board in exactly the same way that earlier carrier aircraft could. Or should we say, if you are kind to these new ones, they bite back. The best way to treat these beasts is to treat 'em mean. The planes like it. They are not only built for it, but test results showed that loads on the structure, particularly the nose gear, were lower when you paid no heed to the deck. Aim the plane for all that tangleweed and hold it on the down course.

Talking over a cup of coffee, being brainwashed by a bunch of engineeers, it is pretty easy to see that the

The A3D on the paddles astern the Forrestal just prior to the cut.

no-flare landing is the softest way to get these new swept-wing aircraft on the ship, but years of field flared landings and flared carrier landings just isn't washed away by discussion. It takes a lot of personal conviction and practice.

The tabulation of static attitudes and carrier approach attitudes shows that the new airplanes are nose-high when they're in the groove. If the hook snatches an arresting wire in the carrier approach attitude, it means that the airplane will not only be rapidly retarded by the arresting cable but will also be whipped, nose down, to a crunching arrestment. If the pilot is fortunate, or precise if you like, the main gears touch down before full retarding forces are developed, and the airplane develops only a small amount of nose-down rotation.

If you try to be a nice guy about the whole thing, or try to look graceful by easing it to the deck, you'll want to hold off a wee bit before you set it down. If you try that in any of these new jobs, brother, look out! Unless, of course, you have vertebrae and nose gears to spare.

When you ease back on the stick on the way down to the deck, you probably have a little extra airspeed to insure good flying qualities in the groove or if you're a family man, a few extra knots for the wife and kids. The margin above the stall will provide speed for elevator effectiveness with which you can really get yourself into trouble. The airplane will rotate nose up nicely and tend to float on the extra speed. If your hook catches a wire during a flare, you'll be lucky, from a medical viewpoint, if

Please turn page

F4D engaging a cross-deck pendant following a mirror landing approach. Landing attitude good. Although arrestation has started airplane still had not rotated onto nose gear.

F8U on mirror approach shown just passing over the ramp. Landing attitude of this airplane very similar to the cut attitude.

What goes for the newest birds is really not different from things that could be said about the F9F or F2H series.

FLARE NOT

Continued

In the groove F11F is shown very "cocked up" during paddles approach.

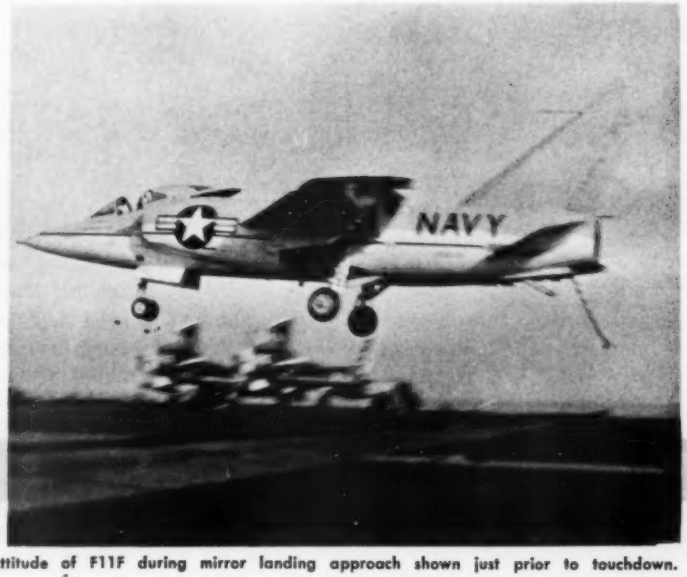
F11F passing over the ramp during mirror landing approach.

the nose gear collapses under the load rather than transmitting the load to your one and only backbone. In most of these new jobs, you're sitting over the nose strut.

Today's design specifications require the nose gear of carrier airplanes to be stronger than they used to be because the slipstick artists who write specs, knew you'd flare as soon as the barrier was removed from the flight path of your teeth. Decoded, the gobbledygook of the spec says that the lower the sink speed of the whole airplane (flared landing) the higher the nose gear loads will be.

The exasperating part is that a flared landing on the beach is what you have been trying to perfect all your flying life. But, it is in the routine field flying that the non-flared concept must be practiced. The days of holding off the nosewheel and skagging the plane down the runway are passing. During every field landing the plane should be eased over to a proper landing attitude and allowed to roll out under positive braking control.

The things we've been saying are not really different from things that could be said about the F9F or F2H series, but it is most important to realize that everything that holds for these airplanes is becoming more so.



Attitude of F11F during mirror landing approach shown just prior to touchdown.

In an F9F-8, the nosewheel is about 13 feet ahead of the main gear. That's definitely a bit of a moment arm to consider when you're trying for a cocked-up landing, but nothing when compared to an arm of 18 feet for the F8U and 26 feet 8 inches for the A3D. The increase in loads that can be developed with those extra feet of moment arm is tremendous.

For the old timers who still use the seat of their pants for flying, it is interesting to note that your favorite flying equipment is secured directly over the nose strut on the F4D and is about 70 inches ahead of the nose strut on the F8U. We mention these dimensions only to show that if you try to ease the plane to the deck with a flare, the high rotation set up during the arrested runout will get you in the end.

The solution is simple—avoid diving for the deck and avoid flared carrier landings. The best landing technique to get the airplane aboard is to fly the mirror glide slope right down to the deck or, on the paddles, start the airplane down at a moderate rate. Don't worry about checking descent. This procedure will insure moderate sink speeds in the neighborhood of 8 to 10 feet per second every time you get aboard. It's not a grease job but the airplane will be "up" for the next hop.

For us, we found that the arguments for a non-flared carrier landing were clear and easy to accept but conviction that resulted in practice was something else again. ●

F11F about to make a shipboard engagement shown in ideal landing attitude.

You got problems? Something on your mind? Questions for Dr. Anthony or Dorothy Dix? Take care of them, before you take off!

Emotional factors in aircraft accidents include the whole range from intense panic in emergencies through the more prolonged and insidious reactions resulting from frustration, worry or anxiety.

There is no reason to expect a pilot to be any less subjected to conflicts and frustrating situations than the rest of the population of the country. A poor mental attitude or low morale may be temporary, just mental fatigue or an accumulation of worries.

Naturally these complaints do not merit a formal psychiatric diagnosis. But they can be distracting enough to put the troubled pilot into real trouble as the central statistic of an AAR.

A case in point: a pilot with over 6000 hours was on a local proficiency flight in an SNJ. He had a lot of recent J-time and it was daylight, with ceiling unlimited, visibility 10 miles, wind calm. He was observed circling at 6000 feet, and was next seen at 300 feet, gear up, full power, nose down!

The accident board concluded that the primary factor causing this accident was pilot error, and "the secondary factor was the psychological state of the pilot due to a pending board of investigation."

In another case, a pilot on final approach lost sight of the aircraft ahead, landed high and hot, and collided with the other plane on the runway. He blew both tires trying to brake to a stop. It was labeled a pilot-error accident.

But what was the background? This pilot had been grounded for anxiety reaction several days before, after a narrow escape on joinup when a friend of his had crashed. He failed to explain his mental state when he was ungrounded by another doctor.

After the accident, he concluded, "First of all, I used very poor judgment in flying this hop in the mental condition I was in at the time. I would have been very relieved had there been no aircraft available."

The board investigating the crash listed as contributing factors: mental attitude, and the pilot's own failure to declare, prior to the flight, that he did not relish the idea of flying this particular hop.

When you're not feeling up to par, you see the flight sur-

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The number of accidents caused by maintenance error and material failure have shown signs of improving. But, the number of accidents involving human error continues at much the same rate. One cause may be—too many pilots flying while under

Mental Stress

geon, and if necessary, he grounds you. Just as he can't let you fly when you are below *physical* standards, he should not let you fly when you are below *emotional* standards. But in the emotional area, you are pretty much on your own. He might see you at the club and notice that you've got a bad cold, but diagnosing that you might have too much on your mind t'aint so easy.

Another case from the accident files points this out. This pilot had two children at home ill, and his wife's pregnancy was not proceeding normally. He had *two* pilot-error accidents in rapid succession. And why wouldn't he? The question is, why was he flying at this time? Especially after the first two accidents?

In his endorsement to an attack training squadron accident, the commanding officer stated: "During the introductory talk given by me to the future students, the subject of false pride and lack of a proper professional attitude is defined. Individuals are encouraged to make known either to me, the ops officer, the flight safety officer and/or the flight surgeon, any personal or professional problems which may tend to reduce their proficiency in flight as pilots. This appeal is made humbly and sincerely so that the pilot under instruction may reveal in confidence his problem!"

Commanding officers, flight surgeons, and operations officers must establish an active program to analyze and observe the pilots under their control with a view toward preventing pilots from flying who are not in the proper physical or psychological state.

Pilots will occasionally encounter stresses such as anxiety, worry or antagonism which they cannot handle adequately. The reaction patterns to such stresses may cause distractions or confusions in the cockpit.

Supervisory personnel and flight surgeons must remain constantly alert for signs that a pilot may be suffering from emotional problems.

Pilots, finding themselves so beset, prove they are men of sound judgment when they recognize a bad personal situation, and take appropriate action.

There's no room in the crowded cockpit of a modern aircraft for outside, personal worries. If you plan to leave the ground, leave your worries on the ground. ●

Reviewing fractured vertebra accidents indicates need for pilots to really cinch up those straps, for flight surgeons to investigate such accidents more in detail, and for the development boys to make with some better high-energy absorption material for our sitters, but soon!

SUSPICION

Suspicion should be a key word in the vocabulary of every good flight surgeon.

Although this applies to every phase of his accident prevention work in aeromedical safety, it is most applicable in diagnosing a type of injury to the spine, "fractured vertebrae," which is increasing as the performance characteristics of our jet aircraft increase.

In every aircraft accident involving a hard landing or ditching, a compression fracture of a vertebrae should be suspected. Once suspicion is aroused, anterior, posterior, lateral and oblique X-ray views should be taken as required. In some instances fractures may be present which are extremely hard to find with the best X-ray technique.

It was found in studying fractured vertebra injuries which occurred as a result of aircraft accidents over a two-year period (1 Jan 1954 to 31 Dec 1955) that those cases in which a fractured vertebrae was associated with fatal injuries had to be eliminated. This was due to the fact that the majority of these cases had been reported as "Injuries Multiple Extreme" with insufficient evidence to relate the forces involved with fractures reported.

There were 59 non-fatal cases reported. However, from this information, it was possible to determine that a typical aircraft accident resulting in a non-fatal compression fracture of a vertebra would have the following general pattern.

The aircraft involved would be a jet fighter model which stalled out at a relatively low altitude in level flight while attempting a normal or emergency landing or ditching. The pilot of this aircraft would have had his shoulder harness and lap belt tight and locked, and he would have received few, if any, injuries other than a compression fracture of his vertebra. In this typical case the fracture itself would involve one vertebra; between the twelfth thoracic and the second lumbar inclusive.

The forces which produced the fracture would be predominately vertical in nature resulting from dropping the plane to the deck in a hard landing.

In aircraft accidents when an injury to the spinal column does occur it is usually a compression fracture. In a sense this type of injury is unique in that it is usually encountered in a survivable crash and is generally the only injury sustained.

This same type of injury

is common in civilian life when similar forces affect the spine. A broken back, as it is generally referred to, still carries with it an unwarranted stigma of being a dreadful accident. This gloomy viewpoint, based on the belief that a complete or partial paralysis or even death is associated with a broken back, is the result of hearsay from the old days. In the pre-X-ray days only the most serious cases of back injury were recognized as such, while the usual type of fracture that may result from an aircraft accident was treated as merely a back strain.

It is rare for a compression fracture of the type under consideration to involve the spinal cord.

However, it must be emphasized that even though this injury is not classified as a serious one, without proper treatment it may result in a prolonged nagging-type disability not very compatible with a pilot's working position.

The forces which produce a compression fracture in an aircraft are such that this injury occurs in spite of the pilot's proper utilization of all his present safety equipment.

By referring to the schematic chart it is possible to understand exactly how this fracture occurs. We can see that with the application of a vertical crash force to the seat of the pilot's pants a series of events takes place. The 10- to 11-inch seat pack assembly and the compressible human substance the pilot has placed on it is fully compressed as the pilot's body is forced down into the seat.

At the same time, due to the anatomical or mechanical design of the spine itself certain changes take place with the pilot in the upright seated position. When a high force is applied to the lower end of the spine this force produces a forward motion of the upper spinal column flexing at the junction between the relatively fixed-rib thoracic vertebra and the movable lumbar vertebra. It can readily be seen that the pilot must move down away from his shoulder harness and then forward with the harness stretching to its variable elastic limit and when this limit is reached he is forcibly returned to the seat with the entire sequence tending to rapidly repeat itself. When the resultant forces from this oscillatory type of motion on the lip-like edges of the vertebrae at their pivot point crushes these edges, a compression fracture has occurred.

As the result of various countries' research tests carried out on voluntary and involuntary human subjects during the war, a G-tolerance limit in the neighborhood of 20 G for one tenth of a second has been established. The time factor in the application of this G is all important.

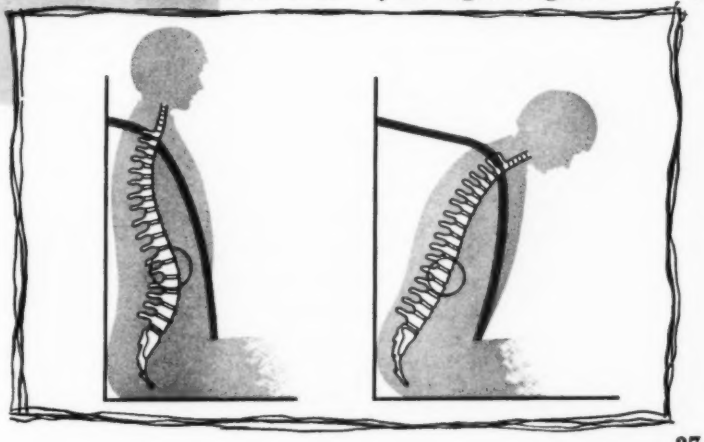
By substituting a nice soft cushion for the designed pararaft, the pilot is asking for a compression fracture. A pilot, in making a hard landing with a cushion, maintains his position and compresses his seat cushion until suddenly the seat bottom catches up with him with a terrific wallop.

The best preventive for this type of injury is to land the aircraft in the manner in which it was designed to be landed.

The development of improved high-energy-absorbing material is in process in order to slow down these impact forces before they strike the vertebral column with a destructive force.

Meanwhile, if you must make a crash-type landing, pull your seat belt and then your shoulder harness *as tight as is humanly possible*, as this discomfort will last only for seconds whereas an injury could plague you for years.

After a hard or crash landing has occurred by all means have the possibility of injury to your spine investigated by your flight surgeon. ●



CAG Three's flight surgeon, Dr. Channing L. Ewing, collected a bag of very good tips and mimeographed them for the pilots and crewmen of his air group. They call attention to some of the more common breaches of good aviation safety practice, and the copy sent to the Aviation Safety Center looked so good we're passing it on to you. *Let's hear from more flight surgeons!*

Helpful Hints

1. When taxiing aircraft on board ship, *always wear a crash helmet with the earphones plugged in, a flight suit, a lifevest, and fasten your shoulder harness and seat belt.* A failing brake and/or a roll of the ship have cost the government a lot of insurance money unnecessarily because of failure to do these things. If you go over the side, with that faintly puzzled look on your face, saying, "Ah, it's only a taxi hop," good intentions about safety equipment don't mean a thing.

2. *Don't* fly with a cold, unless you can hear without eardrums —which is a darn good trick.

3. If you have funny sensations in flight, with blurring of vision, or restricted vision, or headache, abort the hop, go on 100 percent oxygen and head for the deck. Call in by radio and have the flight surgeon notified immediately. Also, if you are at altitude and get an unusually odd radio transmission from one of the other pilots in flight, tell him to descend and get back to the ship field.

4. *Fasten that liferaft lanyard on every overwater hop.* If you want to clear the airplane bad enough, you'll come out wearing the parachute anyway. The raft draws about 3 to 4 inches of water, but you draw about 5 feet, (sometimes 7 or 8 if you don't check your vest properly), so guess what happens when a stray zephyr of 10 to 20 knots hits the raft—right—it will be so far away you can't reach it if it's not attached to you. There is a special giz on the vest harness just to snap the lanyard on.

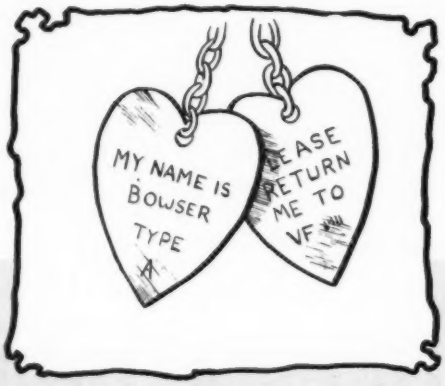
5. Check that oxygen mask *before* every hop. Take it apart and clean it yourself so that you won't be afraid of it due to ignorance. If you need help, get in touch with the squadron oxygen equipment officer, or the flight surgeon.

More on next page

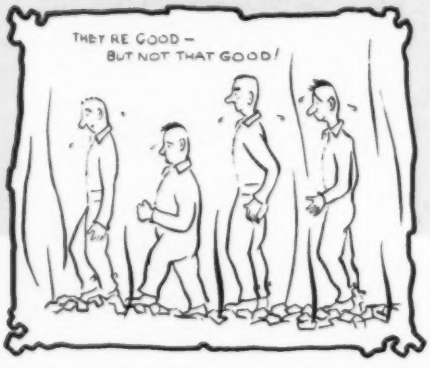
Helpful Hints

Continued

6. If you are really in sad shape after a night of living it up, see your buddy down in sick bay accepting that "hot shot."

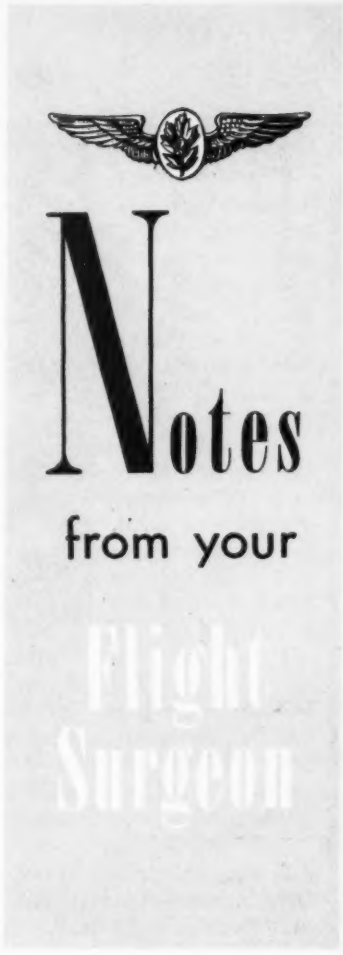


7. *Wear those dog tags*—we may have to give you a blood transfusion real quicklike. And we can't just give you any old blood type that's handy, or you could have a transfusion reaction in addition to your acute injuries. And that's not considered sporting you know.



8. *Crewmembers must wear flight suits* while in aircraft, to prevent burn injury. *No dungarees!*

9. If you want to wach a recovery from Vulture's Row, *dress warmly*—colds are easy to catch, particularly when high interest overshadows common sense.



HYPOXIA AND RELATIVES

Flight Surgeons appreciate the value of the medical distinctions of cause and degree made possible by the careful use of the related terms of hypoxia, anoxia-anoxic anoxia, anemic anoxia, stagnant anoxia, histotoxic anoxia; anoxemia, hypoxemia. . . .

However, the term hypoxia seems to be the most widely used in the aviation world in general.

Our concern is to publicize safety information on these serious oxygen problems as widely as possible, as simply as possible, without confusing our readers.

You will therefore see the single term hypoxia used in these columns from now on in most cases to describe any physiological shortage of oxygen.

VOICE OF EXPERIENCE

This F9F-5 pilot had a few pointers to offer after a successful helicopter pickup. His plane went off the bow as a result of engine failure on catapult and he was rescued within five minutes with only a muscle strain.

"I believe my having my oxygen hose clamp attached to the shoulder harness rather than the parachute harness may have facilitated my exit from the cockpit . . . [It's also regulation.]

"When I did get my vest inflated, I found I had my waist strap adjusted too loose, causing some discomfort. I personally am going to check this and my CO_2 containers periodically from now on.

"The knowledge that the parachute would support my weight easily was a great help to me when I had trouble inflating my lifevest. It *did* support me easily and comfortably.

"The system of getting in to the rescue sling, like putting on a coat, worked perfectly."

DEPTH PERCEPTION

Depth perception is not dependent on the use of both eyes, the USAF Department of Ophthalmology has revealed. This contradicts the previous opinion that depth was dependent on the sense of perspective.

Using only one eye, depth perception can be accurately judged by reference to motion parallax. Parallax is the apparent difference in speed of movement of two objects at different distances from the viewer and can be used to judge the depth of field. Hence it is possible for a pilot who has lost the sight of one eye to land his aircraft safely. (Wiley Post flew for years with the sight of only one eye.)

The USAF has developed a motion-parallax tester in the examination of candidates for flight training.

SURPRISE ATTACK

There was a sudden loud noise. The pilot noticed blood all over the cockpit, and a hole in the top of the canopy near the front. He headed for home, and the attacking enemy was identified by the feathers in the cockpit.

The pilot sustained a cut on his upper lip, and his cheek was cut almost to his eye. Some protection could have been afforded from this injury, as well as potentially serious eye injuries, by the goggles. However, the pilot was wearing his goggles on his forehead at the time of the incident. It is recommended that goggles be worn on the eyes whenever feasible, since fire, birds and other zooming objects are known to attack without fair warning.

While this accident involved a relatively inexperienced mech, experienced pilots and mechs are vulnerable too.

Only when the hangar sprinkler system was shut down, was the heavy foam placed on the wreckage effective in stopping hour-long fire.

KNOB HOB

He was an airman apprentice. He had received a checkout and on meeting squadron requirements, was qualified as a plane captain. He had only 6 weeks of practical experience under his belt, but was considered an intelligent and conscientious plane captain.

On this particular morning his job was to preflight an AD-2 *Skyraider* which was scheduled for a cross-country flight. When the engine started he got the ride of his life.

His AD was secured by a 10-point tie-down; the main fuel tank contained 350 gallons and an external tank of 150 gallons of fuel respectively. He was there, so, let him tell his story:

"I turned the gas to MAIN, put the fuel booster ON and hit the starter for about 16 blades. I turned the magneto switch ON and hit the starter and primer, then, all of a sudden the plane started roaring and jerking. When that happened, it shoved me down into the bucket seat. When I regained my previous position, I looked out of the cockpit and noticed the plane was moving and was going pretty fast toward the hangar, then I really became scared and actually froze. When I hit the hangar door I just blacked out."

Witnesses on the scene reported the engine had backfired, started and accelerated to nearly full power when the airplane parted its tie-down rods and lines, and jumped both chocks. The AD travelled 139 yards between 2 rows of 14 aircraft before striking 2 hangar doors. The doors collapsed on top of the aircraft and fuel from the plane's external tank ignited immediately. The plane captain jumped clear just after the moment of impact with the hangar and was led away from the fire by other personnel. He received only

minor cuts and burns.

The aircraft burned for about an hour before it was extinguished. Fire crews experienced difficulty in putting out the blaze due to the sprinkler system washing away the foam blanket as it was laid down on the aircraft. The sprinkler system was then shut down and heavy foam was placed on the wreckage by MB-1 and MB-2 fire trucks. Damage was confined to the aircraft, hangar doors and a work stand.

Investigators concluded that this accident could have been averted if the plane captain had either secured the ignition switch or pulled back on the throttle control to reduce power. The fact that he had placed the safety belt around the control stick and was sitting under the belt at the time of the accident probably prevented him from being thrown from the cockpit when the plane crashed into the hangar.

"I don't recall how the position of the throttle was," the plane captain said, "in the excitement I don't recall pushing the throttle."

Investigation of the cockpit at the scene after the fire revealed the throttle was two-thirds open.

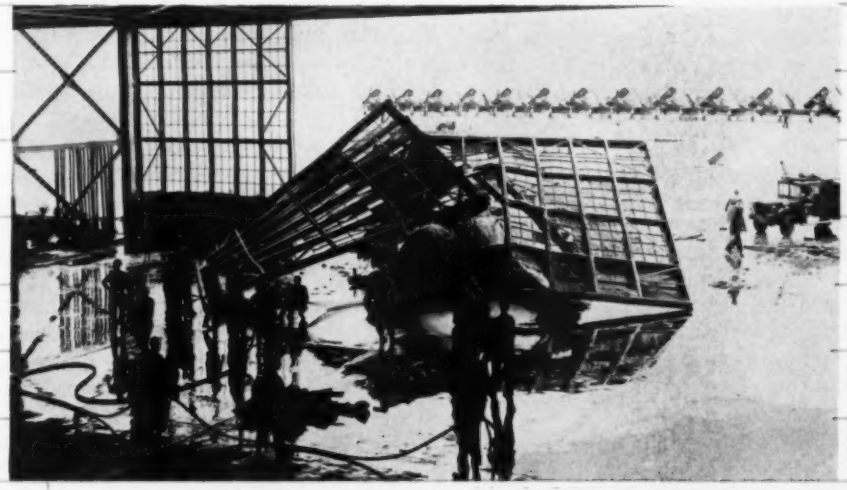
Investigators were of the opinion that the relatively limited experience of the plane captain may have been a contributing factor in his not reacting properly to the emergency.

Since this accident, an item was reported which just goes to show how even experienced people can always learn something new about aircraft they handle and fly every day.

If, for example, the friction knob on the throttle quadrant of AD aircraft is not set reasonably tight for starting, the manifold pressure regulator will open the throttle to FULL OPEN unless you happen to catch it first. When the subject came up there were just about as many opinions on the subject as there were pilots in the discussion.

So, in order to settle the thing one way or the other, an AD was tied down in the turnup spot and started with various settings of the friction knob. Each time the knob allowed free loose movement of the throttle the engine would rapidly accelerate to FULL THROTTLE. The pilot in the cockpit was fully expecting the unusual and on three occasions caught the throttle before it opened all the way. Each time the manifold pressure was approximately 40 inches when he caught it.

The obvious moral is, *be sure those friction knobs are tight before you start the engine.*



Investigation of the cockpit afterwards revealed the throttle was two-thirds open.

TROUBLESHOOTING THE F2H LANDING GEAR

Following a normal (electrical) extension of the landing gear of an F2H, a variety of electrical malfunctions can, and have, caused inadvertent retraction of the gear even though it requires a combination of discrepancies. One exception to this is a direct short between the gear UP wiring and any other wire with 28 volts or a short between a 28-volt wire and the prime power source to the actuator. This type of malfunction would necessarily have to be intermittent as, so far as known, no case of a collapsed gear has been traced to this cause. Therefore, the search for the most probable cause of a gear malfunction will necessarily be restricted to those components, which by their nature, are critical of adjustment and/or wear, the results of which may cause an intermittent malfunction.

All of the switches in the F2H landing gear circuit have built-in features called "overtravel" and "movement differential". Overtravel refers to the additional distance the switch plunger can travel after the "click" is heard indicating that its electrical function has been completed. Overtravel protects the switch against bottoming out.

Movement differential, on the other hand, is the distance the plunger can move before the switch becomes untripped while moving in the direction of overtravel. Therefore, lack of movement differential would permit the switch to untrip with the slightest movement of the switch plunger. Movement of the plunger probably can, and does, occur as a result of a movement of the gear under normal landing and taxiing loads.

Several cases have been reported of gear malfunctions due to main landing gear switches becoming corroded, or the microswitch actuator plunger sticking.

When the landing gear door open limit micro-switch sticks in the actuated position, it makes normal electrical down cycle of the landing gear impossible. Then, when the gear is actuated on the down cycle electrically, with the landing gear open-limit switch stuck in this actuated position, the landing gear door will not open and the landing gear drops against the door. The gear, however, does not drop sufficiently to de-actuate the gear UP limit and UP indicating microswitches. Because of this, the gear cannot be raised back to the UP and LOCKED position from its position resting against the door. With the landing gear *resting against* the closed landing gear door, mechanical binding can prevent the emergency landing gear system from opening the door and allowing the landing gear to fall free.

A hermetically sealed switch (MS25011, Part No. R-17-S-25025-110 or R17-S-32066-5) which is interchangeable with the presently installed microswitch has been authorized by ASC 401.

Excessive wear of the brake can result in a condition similar to that described in the preceding paragraph. It is possible for the actuator brake to slip to such an extent that it will allow the landing gear to bounce back from the full down position, thus untripping the down-limit switch and possibly causing the same sequence of events described above. It is known that on several occasions the pilot's attention was called to the cockpit indicator which went to the "barber pole" while on the landing rollout. In each case, complete collapse of the gear was prevented by the prompt action of the pilot in not attempting a sharp turn under these circumstances.

Lack of differential in a limit switch can usually be detected by the absence of the click normally heard when the switch plunger is depressed. An examination of the switch mechanism in the event the switch is suspected, should reveal that the leaf spring, which controls the clicking mechanism, no longer is effective. Replacement of the switch is thus necessary.

It is realized that these items by no means exhaust all of the possibilities contributing to a malfunction, but they do appear to offer the best probabilities. On various occasions the

fact that the actuator's attachment to the side braces breaks when the gear collapses has been pointed up as the prime cause. This, however, is believed due to the fact that once the side braces become unlocked, the weight of the aircraft forces the gear to retract while the actuator is attempting to hold the gear down.

It is interesting to note that there have been quite a few cases of the main actuator end cap breaking on the -3 aircraft. In no case did the gear collapse even though the incident was not discovered until the aircraft had arrived on the flight line. Since the side braces on the -3 are steel instead of aluminum, the weak point in the linkage has been transferred to the actuator and cap.

One more point might be brought out in relation to the main gear scissors switches which have frequently been suspected of causing a gear malfunction. The fact is that even if both scissors switches are defective to such an extent that they no longer act as safety switches, they will not contribute to a collapsed gear unless some other discrepancy is present in the landing gear circuit. Thus, it can be seen that a total of three switches would have to malfunction simultaneously to produce a gear retraction under these circumstances, although it is probable that this has actually happened.

Unfortunately, the electric landing gear of the F2H does not readily lend itself to preventive maintenance. It seems to be the nature of things electrical that potential electric failures do not readily make themselves known. The best that can be done is to concentrate on those items which are most likely to cause trouble if they are defective or maladjusted. Therefore, in troubleshooting discrepancies in the landing gear system, the following points are again emphasized:

1. Dropcheck the landing gear system functionally anytime a discrepancy is reported.
2. Check for proper landing gear door rigging and preload of actuator.
3. Check to see that all microswitches are free of corrosion and are in good working condition both electrically and mechanically.
4. If there is any doubt as to the condition of gear/door actuators, replace same.
5. Check all relays and related wiring for proper operation and good condition.

MURPHY* IN AN SNB

*If an aircraft part can be installed incorrectly, someone will install it that way.

The return lift of an SNB was to take only 50 minutes so the pilot did not have the aircraft refueled. The left 25-gallon had been used on the flight just previous. Lacking a copilot the pilot who had 3000 hours, 400 of which were in SNB aircraft, had one of his four passengers fill the right seat to act as an observer.

The pilot went over his pre-takeoff checklist putting the fuel selector on RIGHT MAIN and the fuel gage switch on RIGHT MAIN. The takeoff was normal until an altitude of about 75 feet was reached; then just before the gear was to be raised, the left engine quit, the plane veered to the left, then the right engine quit. The pilot was able to make a safe deadstick landing. He stopped within 15 feet of the end of the runway.

A quick inspection showed that the fuel selector handle was installed 180 degrees from its intended position. In other words, the selector valve was on the EMPTY TANK.

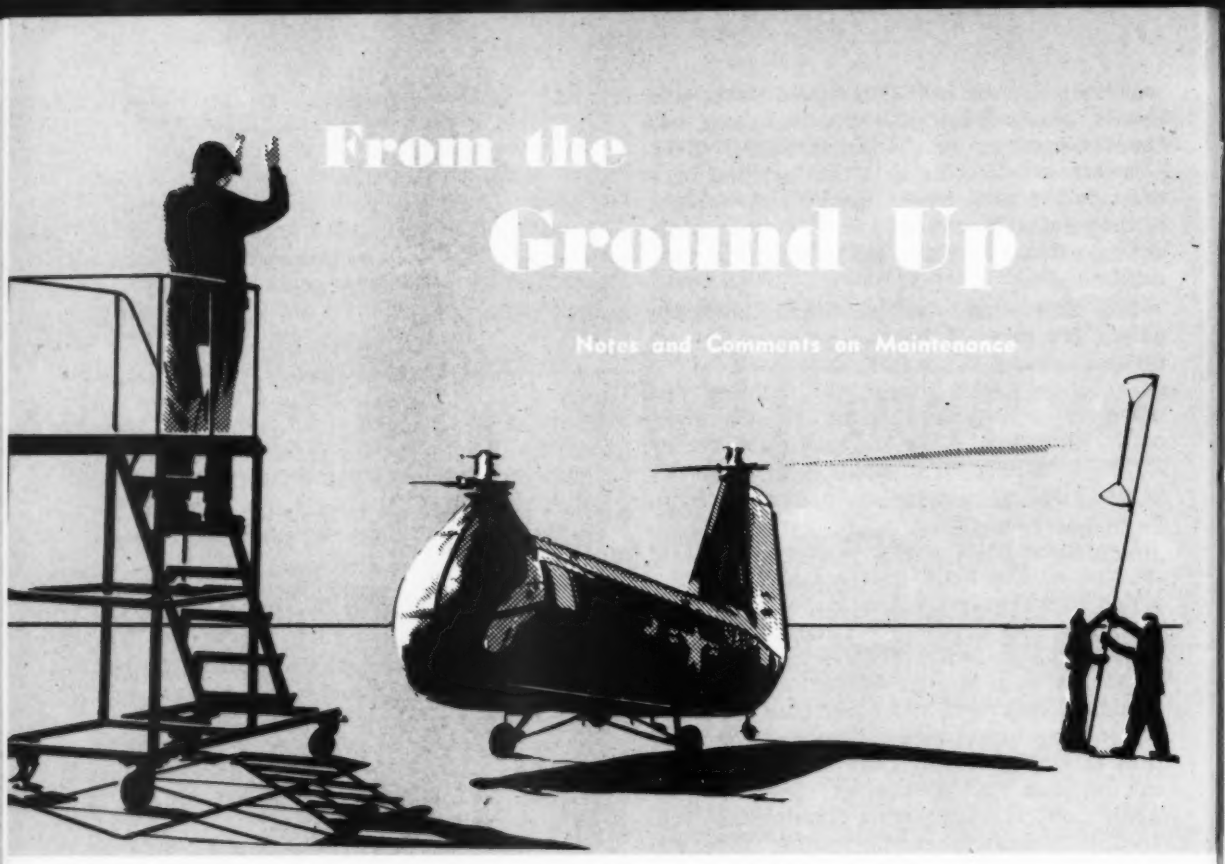
In a second incident involving an identical Murphy in another SNB, the engines cut out on the downwind leg of a touch-and-go, the pilots managed a restart while still in the air.

The pilot in the first case made the following observations: That two heads are better than one, recommended a qualified copilot for all flights involving proficiency pilots or any pilot who averages less than 10 hours per month.

That the rule about using all of the runway available for takeoff helped prevent another aircraft accident.

That the rule about not raising the landing gear until a safe landing cannot be made on the runway remaining ahead, also helped.

Although the first pilot failed to mention it, the pilots in the second case noted that mechanics, upon rigging selector valves should always make checks necessary to insure proper rigging, and that pilots should note fuel gage readings as fuel is consumed.



From the Ground Up

Notes and Comments on Maintenance

TRACKING HUP ROTOR BLADES — Reports have been received relating improper procedures in tracking rotor blades. An unlocked tailwheel in some instances allowed torque forces generated by turning rotor blades to move the 'copter into tracking gear. In other instances the tracking flag was pushed too far into the path of blade tips.

Many different techniques are utilized by various helicopter units in tracking of rotor blades. A recommended procedure utilizing three men is described here:

1. A signalman should be stationed at a good vantage point in front of the aircraft where he can see clearly the rotor blades, the tracking pole and the other men. He observes the position of the pole relative to rotor blades and furnishes approximate signals for movement of the pole.

2. A signal relay man is positioned at the point beneath the outer blade periphery where the tracking pole is placed. He should place one foot firmly on the ground with the instep ırom the signalman to the tracking pole controller. The signal-relay-man's hands should not touch the pole under normal procedure.

3. A tracking pole controller stands next to signal relay man with his hands firmly on the pole and keeps his eyes fixed on the tracking flag and rotor blades. He receives the verbal signals from the signal relay man and positions the pole accordingly.

This procedure minimizes jerky movements of the tracking pole and helps insure a soft easy touch of the flag against the blade tips. Additional details are contained in HUP Manual AN 01-250-HCA-2.

Note: The use of an aluminum tracking pole, a standard issue item, tends to bend inboard as the rotor tips strike the tracking flag. One outfit reported after an accident, the light, flexible pole is especially hazardous to use when any wind is blowing. Winds in this case were steady at about 10 knots. The squadron recom-

mended the use of a stiff steel pole, utilizing a broader tracking flag. The pole can be manufactured locally.

FOR WANT OF—The instructor pilot was unable to recover from an intentional syllabus spin entered by the student, which resulted in the student's death and the destruction of the TV-2. The reason recovery wasn't possible—the empennage section of the aircraft was missing when the recovery was attempted. The reason the empennage was missing—3 Airloc (Dzus) *fasteners were unfastened before the flight began!*

The pilot of a previous flight in this aircraft had written on the yellow sheet: "three Dzus buttons won't hold on rear edge of starboard engine access door." The structural mechanic who wrote: "set cam locks—one is still a little loose but is O.K." had actually repaired three Airloc fasteners on the *lower* starboard engine access door. This pilot was referring to the *upper* engine access door, but had failed to specify it.

The accident occurred when the upper plenum chamber access door separated from the fuselage due to a combination of being improperly secured and being subjected to unusual airflow. The door hit the vertical fin sometime after the spin rotation stopped. The resulting combination of stresses caused the empennage to separate from the fuselage, aft of the mating joint.

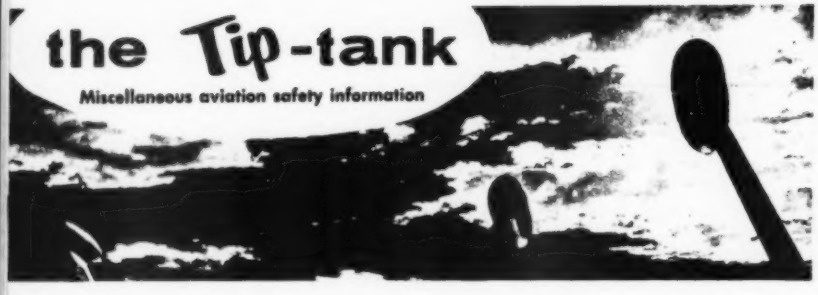
The Field Service Technical Section of Lockheed Aircraft Corporation advises that one missing Airloc fastener may result in "unzipping" the whole line. After this crash, a total of 20 fasteners were found unfastened, 11 more were torn out, and 12 were missing sections of the access door.

The "Air Force Maintenance Review" of November 1954 reported an identical failure: "*one* faulty Airloc fastener may cause the loss of an upper access door during flight . . . The crux of the situation is that maintenance personnel are not securing the fasteners properly, and are not replacing worn or broken fasteners . . . On several occasions, the receptacles of the fastener assembly have failed in service." This caused *six* USAF accidents in *three* months.

GENERATOR SNAFFLE—After refueling at an intermediate stop on an F9F ferry flight, the pilot experienced complete loss of radio communications. Upon returning to the line the generator was found to be burned out. The generator was replaced. The pilot elected to take off at night (VFR) for the next leg of his journey. En route to the next stop complete communications and electrical failure were experienced again. Upon reaching his next destination the pilot had to buzz the field to get runway lights turned on. Due to the electrical failure speed brakes could not be extended, so the pilot landed fast and ran off the end of the runway.

The maintenance crew that installed the generator at the previous stop had failed to remove the air cooling spout and window strap furnished with the generator and replace with the screen as specified in paragraph 7-29 of the Handbook of Maintenance Instructions (AN 01-85FGD-2). Furthermore the wooden shipping plug was left in the air cooling spout. As a result the newly installed generator overheated and failed after approximately one-half hour of operating time.

"Beware of forward rotor blades" warns the sign at the cockpit entrance of this HUP. The rear part of this droopy 'copter has no rotor blades at all. A material failure caused the rotor clutch to bring the rotor from very slow rotation to high speed. The blades sheared at the rotor and were slung a considerable distance from the aircraft. No personnel injuries resulted, due in part to the farsighted squadron policy which permits only essential personnel in the vicinity of helicopter operations. In other words beware of those aft rotors, too!



'COPTER DITCHING TECHNIQUE

Helicopter ditching experience indicates a strong likelihood of incapacitating injuries being sustained by passengers as well as crew members if seat belts and shoulder harness are unfastened prematurely in anticipation of ditching.

The rule for fixed-wing aircraft remains: "unfasten when all forward motion has ceased." In helicopters there may be no forward motion, but the rotors are still whirling.

Because severe vibration and jolting occur when the helicopter's blades strike the water, unsecured passengers may be violently thrown about at this time.

Although the primary responsibility for instructing passengers in survival techniques still rests with pilots, it is desirable that all non-aviation personnel be aware of this hazard peculiar to helicopters.

ANTI-FOG

BuAer has received information which indicates the majority of operating squadrons are either overlooking rain repellent and anti-fogging compounds or consider the time required to apply them to windshields excessive.

Actually, not over 15 minutes is required to apply either the rain repellent or anti-fogging compounds, and the effects are good for 25 hours of flying. The benefits of such treatment have been attested by reports from operating squadrons, the air force and by commericial airlines.

Technical Note 1-55 gives the stock numbers for obtaining the materials for treating windshields plus the manner of application.

HEY!

OpNav Instruction No. 3750.6 B is now out and effective 1 July 1956. Have you read it? Whether you call it Six-Baker or Six Bravo, it's the latest dope on Aircraft Accident, Incident, and Forced Landing reporting procedure. Read it, *Use* it—NOW!

CONGESTED TERMINAL AREAS

A TV-2 and a commercial airliner narrowly averted a head-on collision at 4600 feet over the northeast corner of Moffett Field one afternoon.

Both aircraft were VFR and the attention of pilots in both aircraft were diverted momentarily by an R6D which was maneuvering close by.

The commercial pilot got a glimpse of the TV-2, closing head-on, and he dove, fully expecting a crash. The TV-2 pilot reported that he had just noticed the airliner at about 9 o'clock position, 75 feet below him.

In a discussion of this near-miss the CO of Moffett Field noted the following items which are applicable to any terminal area:

- The field is located in an area of high traffic density with a multiple of converging airways. Extreme vigilance and minimum safe operating speed must be maintained . . .
- Attention must not be centered on one aircraft . . . A continuous scan must be maintained as there are always more than two aircraft in the immediate area at the same time.

BUAER CRASH REPORTS

A reminder that BuAer Instruction 11135.1 of 17 June 1953 requires a report submitted on NavAer Form 2325 for each aircraft emergency wherein the crash organization actually performs rescue, fire-fighting or salvage operations. This is exclusive of carrier accidents at sea. The purpose of this report is to provide significant information on the effectiveness of equipment and personnel.

OLD PRO CLUB

ROSTER

Frank G. Edwards, Comdr., USN, Pilot
Clarence F. Frassard, Comdr., USN, Copilot
YTF-1 Service Test, NATC

Unable to extend the nosewheel of the YTF-1, Commander Edwards elected to land with main gear down, no flaps, and to feather both propellers when on the runway. Immediately after touchdown, Commander Frossard feathered the props and positioned the blades by use of the starter motor so that maximum ground clearance was obtained. The nose was slowly lowered to the runway as elevator effectiveness was lost in the rollout. The resultant damage was *very* minor due to a well planned and well executed landing procedure.

Daniel V. McDonald, 1st Lt., USMCR
SNJ-5, BTU-1N

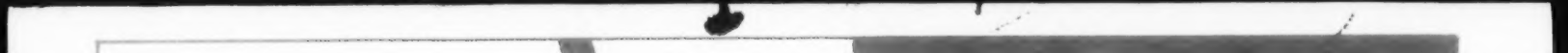
On his fifth solo flight, having a total of only 43.5 pilot hours (all in SNJs), 1st Lt. McDonald experienced engine failure following takeoff. Although the canopy was covered with oil and visibility thereby reduced, he made a deadstick landing on the field without damage to the aircraft.

William Francis Culley, Comdr., USN
HSS-1 AirDevron ONE

A sheared shaft in the transmission oil pump with resultant loss of oil pressure required Commander Culley to make a forced landing on the deck of a submarine. Maneuvering only in rearward and sideward flight, he eased the helicopter onto the submarine's 12-foot-wide deck which was just big enough to accommodate the spread of the main wheels. There was no damage to the helicopter.

'HURREVAC ONE'

It's the season for the reason aerologists get that strained, suspicious low-pressure-cell-look — and for sharp operations officers to get set for a possible blind date with any one of the "Miss Hurricane's of 1956," from **Anna** to **Zenda**.

Break out the evacuation plans, bring the storm bills up to date, tote up the flyaway packets, brief all hands on their chores, check your refuge point liaison arrangements, and keep the HurEvac schedule up to the minute. Reference material to assist in your preparations may be found in **Naval Aviation Safety Bulletins** 16-54 and 23-54, and the Safety Officers Planning Guide (month of May).

Note to our overseas readers: We didn't forget — just substitute "Typhoon," . . . for stateside hurricane-types, and the precaution holds good for you too!